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UGANDA PROTECTORATE.



ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR ENDED 31ST DECEMBER, 1927.

Price: Shs. 4/50.

Published by Command of His Excellency the Governor.



ENTEBBE:

PRINTED BY THE GOVERNMENT PRINTER, UGANDA.
1928.



NEW AGRICULTURAL LABORATORY, KAMPALA.

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STAFF LIST.

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<i>Statistician, and Secretary Cotton Board...</i>			A. S. WIDGERY.
<i>Office Superintendent</i>	...	...	G. A. READ.
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GENERAL DIVISION.

Senior Agricultural Officers.

A. R. MORGAN. R. G. HARPER.

Superintendent of Agricultural Education.

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Agricultural Officers.

J. D. SNOWDEN. R. T. WICKHAM. C. E. J. BIGGS, B.Sc. (LOND.), DIP. AGRIC. (WYE).
D. STEDMAN-DAVIES, B.Sc. (WALES). A. B. KILLICK, B.Sc. (LOND.), DIP. AGRIC. (WYE).
N. S. HAIG, B.Sc. (LOND.), DIP. AGRIC. (WYE). E. F. MARTIN, DIP. AGRIC. (HARPER ADAMS AND NORTHANTS).

Coffee Officer W. L. MUNN.
Cotton Grader and Ginning Inspector MAJOR N. G. WRIGHT.

Plantation Managers.

G. T. PHILPOTT. F. W. HALL. CAPT. J. S. HARMSWORTH, M.C.
C. HAZEL. P. CHANDLER. E. A. RUCK.

Ploughing Instructors.

E. M. BAIRD. A. L. STEPHENS. G. H. THOMAS.

SCIENTIFIC DIVISION.

Entomologist H. HARGREAVES, A.R.C.S., D.I.C., F.E.S.
Assistant Entomologist G. L. R. HANCOCK, M.A. (CANTAB.), F.E.S.
Mycologist C. G. HANSFORD, M.A. (CANTAB.).
Botanist L. C. C. LIEBENBERG, B.Sc. (TRANS.), M.Sc. (MCGILL).
Cotton Botanist G. W. NYE, B.Sc. (LOND.), DIP. AGRIC. (WYE).
Agricultural Chemist W. S. MARTIN, Ph.D., M.Sc. (LOND.), A.R.C.S., D.I.C., A.I.C.

CLERICAL STAFF.

J. C. DE SOUZA. A. S. REMEDIOS. M. A. S. MENEZES.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT, 1927.

Addresses of Officers and Telephone Numbers.

					<i>P.O. Box</i>	<i>Telephone</i>
					<i>No.</i>	<i>No.</i>
DIRECTOR OF AGRICULTURE	...	...	..	Kampala	281	189
HEAD OFFICE	...	...	...	Kampala	281	15
AGRICULTURAL LABORATORY	...	...	...	Kampala	5	18
BOTANICAL GARDENS AND METEOROLOGICAL OFFICE	...	...	...	Entebbe	60	38
JINJA OFFICE	...	...	...	Jinja	67	22

PRINCIPAL EXPERIMENTAL STATIONS.

- (1) Kampala. (2) Serere, Teso. (3) Bukalasa, Mengo.

SUBSIDIARY EXPERIMENTAL STATIONS.

- (1) Ngetta, Lango. (2) Simsa, Teso.
 (3) Fort Portal, Toro. (4) Kakumiro, Mubende.
 (5) Bugusege, Bugishu.

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ANNUAL REPORT
OF
THE DEPARTMENT OF AGRICULTURE,
UGANDA PROTECTORATE,
for the Year ended 31st December, 1927.

Staff.

The following staff appointments and movements took place during the year:—

MR. A. R. MORGAN, Senior Agricultural Officer, went on leave on August 6th.

MR. C. E. J. BIGGS, Agricultural Officer, returned from leave on May 11th.

MR. D. STEDMAN-DAVIES, Agricultural Officer, went on leave on April 30th and returned on November 25th.

MR. G. F. CLAY, Agricultural Officer, went on leave on March 6th, and was transferred to the staff of the Amani Research Station with effect from July 15th.

MR. A. B. KILLICK, Agricultural Officer, went on leave on May 26th.

MR. N. S. HAIG, Agricultural Officer, returned from leave on May 11th.

MR. E. F. MARTIN, Agricultural Officer, arrived on November 9th on first appointment.

MR. G. L. R. HANCOCK, Assistant Entomologist, went on leave on July 9th.

MR. G. W. NYE, Cotton Botanist, returned from leave on April 14th.

DR. W. S. MARTIN, Agricultural Chemist, returned from leave on October 1st.

MR. T. D. MAITLAND, Botanist, was on leave at the commencement of the year and was transferred to the British Cameroons with effect from April 19th.

MR. L. C. C. LIEBENBERG, Botanist, arrived on December 15th on first appointment.

MR. F. W. HALL, Plantation Manager, went on leave on September 7th.

MR. P. CHANDLER, Plantation Manager, went on leave on April 30th and returned on December 22nd.

MR. C. HAZEL, Plantation Manager, went on leave on July 23rd.

MR. E. A. RUCK, Plantation Manager, returned from leave on June 12th.

MR. E. M. BAIRD, Ploughing Instructor, went on leave on November 11th.

MR. A. L. STEPHENS, Ploughing Instructor, went on leave on February 19th and returned on October 17th.

MR. G. H. THOMAS, Ploughing Instructor, arrived on July 10th on first appointment.

MR. H. ALLEN, Ploughing Instructor, was on leave at the commencement of the year and resigned on April 20th.

General.

2. The weather conditions during the year under review were in distinct contrast to those prevailing during 1926. Records show that the rainfall throughout the Protectorate was generally below the average, and the unfavourable climatic conditions adversely affected the production of all crops.

The months of May to August were abnormally dry, and there was a partial failure of both the early and late rains in most areas. The Eastern Province in particular suffered severely, whereas in the Buganda and Northern Provinces conditions were rather more favourable.

Towards the close of the year the food crop position in parts of the Eastern Province became acute, and steps were being taken by the Government to deal with the threatened famine conditions.

Exports.

3. The value of domestic produce exported amounted to £2,310,260, a decrease of £1,287,179 compared with the previous year. This was due to the decreased export of cotton and considerable fall in the value of that commodity.

A table showing details of exports during the year is given below, and comparative tables will be found in Appendices 9 and 10.

Description.		Quantity.		Value. £	Per cent.
Cotton, Raw	...	526,911	centals	1,690,838	73·19
Coffee, Raw	...	43,514	cwts.	170,407	7·37
Cotton Seed	...	29,500	tons	170,303	7·37
Hides (dry and dry salted)	...	29,619	cwts.	99,541	4·31
Rubber, Plantation	...	14,463	centals	82,077	3·55
Ivory	...	499	cwts.	34,574	1·50
Tin Ore	...	117½	tons	20,875	0·90
Sugar	...	10,161	cwts.	16,371	0·71
Sim-sim	...	710	tons	13,732	0·60
Other exports	...	—	...	11,542	0·50
				£2,310,260	

Cotton.

4. (a) *1926-27 Crop.*—In the Eastern Province the marketing of the crop started on January 10th, except in the Busoga District, where buying opened a fortnight later. Favourable weather during the picking season compensated to some extent for the excessive rain during the previous months, and although the yield was below the average, there was a marked improvement in grade.

Under Section 40 of the Cotton Ordinance, a period of four weeks was prescribed from the beginning of the buying season, during which no raw cotton other than “good” or “ordinary” could be bought in the Eastern Province, except in Busoga District, where the quality was limited to “good” only. This action undoubtedly met with a definite measure of success and helped to raise the standard of the lint exported from this Province, where the total crop amounted to 41,097 tons of seed cotton, a decrease of 23% when compared with the figure for the previous season. This falling off was mainly due to adverse climatic conditions.

In Buganda Province conditions were rather more favourable. Buying commenced on February 7th, and the crop reached a total of 29,216 tons of seed cotton. Only “good” raw cotton was purchased during the first month.

The exports of cotton lint from Mombasa amounted to 131,728 bales of 400 lbs. each, this total being 49,129 bales less than in the previous year.

(b) *1927-28 Crop.*—In the Eastern Province the shortage of rain during the months of May to August resulted in a considerable delay in the planting of the crop. Climatic conditions continued to be erratic during the remainder of the year, and the general condition of the crop at the end of December indicated that the yield per acre would be below normal.

The following extracts from the Annual Report by Mr. R. G. Harper, Senior Agricultural Officer, are of interest:—

“The past year was remarkable for its moderate rainfall and high range of temperatures throughout, conditions which were common to the whole of the Eastern Province.

The year bears many resemblances to the dry year of 1918, when the total rainfall was about 40 inches and was the cause of acute famine in that and the following year.

The dry weather in May was all against the early preparation of land for cotton and, with the exception of some ploughed areas, very little early planting was done. Weather was again unfavourable during the whole of June, and by the end of that month less than one-quarter of the normal acreage had been planted. Cultivation of virgin soil became very difficult owing to lack of moisture; numerous plots were thus very badly prepared before sowing.

The early sown cotton benefited greatly by the light rains in the latter half of September, but unfortunately this period was followed by the driest October on record when the rainfall was only 0·05 inch against an average of 6·66 inches. A drought at such a critical period forced reproductive growth to such an extent that the late sown cotton commenced to flower when only a few inches high. The early sown cotton was in a better condition to stand the heat as it had

already formed greater vegetative growth. Further rains in November improved the plants slightly by inducing further vegetative growth with a renewal of budding and flowering, but this period was again followed by dry easterly conditions and consequently the intermediate flush of bolls will be a small one.

Large quantities of cotton have been picked from the May, June and early July plots, but the yield from late sown plots will be low."

In the Buganda Province conditions were more favourable, and as the planted area showed a considerable increase there was every prospect of a satisfactory crop. The following is an extract from the Annual Report by Mr. N. S. Haig, Agricultural Officer:—

"The bulk of the crop was sown later than usual, owing to unusually dry weather conditions during the first half of the planting season. This resulted in the earlier sowings being rather patchy.

Useful rains fell during November, and in mid-December three to four inches were recorded, an unusually large amount for this month. These were very beneficial to the later sowings, and prospects improved very considerably. At the end of the year an average crop was assured.

The shortage of rain was considerably more felt on the light soils in Buruli and North Bugerere where later sowings largely failed. Only a small crop is expected from these areas."

The table below gives the approximate figures of acreages planted in the various districts. For the purpose of comparison, figures for the previous year are also shown:—

				1927	1926
EASTERN PROVINCE:—					
Busoga District	...	...	77,654	...	88,503
Budama "	...	...	21,710	...	35,751
Bugwere "	...	..	55,000	...	53,187
Bugishu "	...	...	25,500	...	45,907
Teso "	...	...	69,737	...	95,774*
Lango "	...	...	53,000	...	61,697
TOTAL				302,601	380,819
BUGANDA PROVINCE:—					
Mengo District	...	...	108,000	...	90,000*
Entebbe "	...	...	40,000	...	25,000
Masaka "	...	...	22,000	...	16,000*
Mubende "	...	...	30,000	...	25,000
TOTAL				200,000	156,000
NORTHERN PROVINCE:—					
Bunyoro District	...	...	9,750	...	13,900
Gulu "	...	...	10,930	...	9,930
Chua "	...	...	7,023	...	7,405
West Nile "	...	...	300	...	500
TOTAL				28,003	31,735
WESTERN PROVINCE:—					
Toro District	...	...	2,400	...	1,535
Ankole "	...	...	—	...	100
TOTAL				2,400	1,635
GRAND TOTAL				533,004	570,189

*Revised figures.

(c) *Transport*.—The extension of the Kenya and Uganda Railway was completed to Jinja by the end of the year, and was opened for ordinary traffic early in January, 1928. Prior to the completion of the embankment and bridge over the River Mpologoma, a large proportion of the Busoga crop was moved by rail from ginneries to the lake port at Jinja, and cotton from the Mount Elgon area was transported direct from Tororo station to the Coast.

With the completion of this railway the greater part of the crop from the Eastern Province is now railed direct to Mombasa. This obviates the necessity for crossing Lake Victoria, with consequent reduction in the number of transshipments.

There was a considerable increase in the use of motor transport during the marketing of the 1926-27 crop, and keen competition to obtain cotton resulted in

ginners and other buyers maintaining fleets of light motor vans. These vans toured the country-side for prospective sellers, who were then transported, together with their cotton, to the buying point, either at a nominal rate or without charge.

(d) *Cotton Seed*.—Owing to the satisfactory movement of baled cotton to the Coast, it was again found possible to relax the restrictions on the movement of cotton seed, and exports commenced on April 1st.

The total quantity of cotton seed exported during the year amounted to 29,500 tons, valued at £170,303, compared with 35,360 tons valued at £194,887 in 1926.

(e) *Cotton Ginneries*.—A detailed list of ginneries is given in Appendix No. 11. One hundred and eighty-six ginneries were licensed to gin and bale cotton during the year, of which number one hundred and seventy-seven were actually working, the remainder being used purely as buying depots. This latter practice is likely to become more widespread. The cost of ginning remains at an unreasonably high level, and centralisation, with the consequent reduction in overhead charges, must tend to establish the ginning industry on a better basis.

In spite of the fact that the number of ginneries is far in excess of requirements, four new ginneries were built during the year. Uganda has now one hundred and ninety-two ginneries and more than half of them are a serious handicap to the country and the cotton industry. In the year 1920, when the number of ginneries was sixty-eight, it was recommended that legislation should be enacted to prohibit the erection of further cotton ginning and baling machinery but no action was taken, although even at this date sixty-eight ginneries could easily handle the whole of the cotton crop.

The handling of the cotton at ginneries and press houses in many cases leaves much to be desired. Generally this is due to lack of knowledge, but often carelessness is much in evidence and this is to be deprecated in dealing with such a valuable commodity as cotton.

The number of licences issued in each Province was as follows:—

				1927.		1926.
Eastern Province	...	...	...	99	...	99
Buganda	..	...	...	75	...	65
Northern	..	...	...	10	...	10
Western	..	...	...	2	...	2
TOTAL				186	...	176

In addition to the above, two press houses were licensed in the Mengo District of the Buganda Province.

Nine ginneries changed hands during the year.

(f) *Cotton Grading*.—During the year, the Cotton Grader visited 106 working ginneries in various parts of the Protectorate, and the following extracts are taken from his Annual Report:—

“A limited number of raw cotton standards have been made up and distributed to all Agricultural Offices. These will undoubtedly help in grading, as these standards show the actual grade required, whereas if grade is described it is a most difficult matter to determine the exact quantity of leaf, stain, etc., which is allowed.

The quality of the cotton was good, the grade holding up very well.

Staple, taken on the whole, was good and hard, running from ‘good’ $1\frac{1}{8}$ to ‘good’ $1\frac{3}{8}$ inch.

Complaints have been received from the home market of oil in the bales, and this will make the yarn streaky. It will also cause some difficulty during the dyeing process and it is a matter which will have to be watched carefully by all concerned.

I am of the opinion that this oily cotton comes from the ends of the rollers where the cotton is allowed to come into contact with the oil used on the bearings. If a piece of tin were used to stand between the end of the roller and the bearings it would certainly help to stop the cotton coming into contact with the oil; I found that in certain cases this was being done, and I suggested the general adoption of this practice.”

(g) *Cotton Board*.—Five meetings of the Board were held in this office during the year. Under the amended constitution (The Cotton Ordinance, 1926) the Board consists of thirteen members, of whom six are officials, with the Director of Agriculture as President.

(h) *Cotton Tax*.—On January 1st, 1927, the Cotton (Tax) Ordinance, 1926, came into force, and taxation was based on a sliding scale, of which full particulars were given in the last Annual Report. The tax was fixed at two (shilling) cents per pound for 1927, and on December 16th the basis for 1928 was fixed at six cents.

The amount collected during 1927 was £51,478, as compared with £199,897 for the previous year.

(i) *Local Trading*.—The local trade in baled cotton is rapidly increasing, and during the year 960 contracts were registered with this Department. The number of bales involved amounted to 120,300, though it must be noted that this total includes many lots which changed hands more than once.

(j) *Destination of Uganda Cotton*.—Of the 131,728 bales exported in 1927, the direct shipments were as follows:—

					Bales.
Great Britain	...	...	...	...	35,125
India	...	...	...	...	65,846
Japan	...	...	...	...	29,697
TOTAL	...	...	...	...	130,668

Both Great Britain and Japan actually take more cotton than the figures indicate as, when markets are favourable, India re-exports cotton to both countries.

Coffee.

5. (a) *European Plantations*.—A full report by the Coffee Officer is given on page 23.

Annual returns received from European and Indian plantations show that the area under *Coffea arabica* is approximately 13,561 acres. This shows a slight increase on the previous year's figure, which is mainly accounted for by increased activity in the Toro District.

In other parts of the Protectorate more attention is being given to *Coffea robusta*, and the area under this crop shows an increase from 2,483 acres in 1926 to 4,682 acres in 1927.

The year's crop was above the average, and prices were maintained at a satisfactory level.

(b) *Native Coffee Industry*.—The native coffee industry made further progress during the year, and the demand for seedlings was greater than the supply.

The cultivation of *C. arabica* is confined mainly to the foothills of Mount Elgon, and the following extract from the Annual Report by Mr. J. D. Snowden, Agricultural Officer, gives particulars of the state of the industry in that area:—

"*Bugishu Coffee*.—It was not a very good year for planting, but trees were put out whenever the weather was at all favourable. The approximate numbers of trees planted, together with those for previous years, are given below:—

County.					Total to end of 1924.	Planted 1925.	Planted 1926.	Planted 1927.	Total to end of 1927.
North	...	...	...	...	71,638	37,972	42,936	128,563	281,109
South	...	...	...	...	107,649	59,085	81,282	70,350	318,366
Central	...	...	...	...	3,210	2,202	4,000	10,000	19,412
TOTALS					182,497	99,259	128,218	208,913	618,887

The total acreage (at 700 trees per acre) is thus approximately 884 acres.

The coffee nursery at Buyobo was closed down after all the trees had been distributed, and a new one opened in its place at Budadiri. A new nursery for Central Bugishu was opened at Mbale. The other nurseries were maintained. The following trees were distributed to natives during the year:—

Nursery.					No. of trees.
Buyobo	...	...	...	...	25,150
Bulago	...	...	...	...	23,986
Bubulu	...	...	...	...	52,840
TOTAL	...	...	...	...	101,976

The demand for trees was greater than the supply, and it is important to note that the natives have themselves raised 50% of the trees planted out during 1927. Buwalasi Gombolola, which was one of the first to make real progress in coffee cultivation, now raises all its own trees and, during the year, planted no less than 42,372. Other Gombololas are also increasing the number of trees they are raising themselves, and I expect to see a very great increase in this respect during 1928.

The experimental plots maintained by the Native Administration, at various Gombololas in the coffee districts, have shown the inadvisability of planting *Coffea arabica* under banana shade in Bugishu. In most plots the trees under such shade have done very badly and have given very small crops. Shade trees, however, seem likely to be beneficial at lower altitudes (4,500 to 5,000 feet), and experiments with these are being continued. Above 5,500 feet shade would appear to be unnecessary.

Returns received from the coffee buyers show that the crop for 1926 was approximately 90 tons. This year there has been a good crop, particularly on the young trees, but the dry weather had an adverse effect on the coffee at lower altitudes. However, I should think that the crop should not fall short of 120 tons. Prices have not been quite so good this year and at first only 20 cents were offered. Better prices, however, were forthcoming when the natives refused to part with their coffee at such a low price, and from 30 to 35 cents per lb. were obtained for good quality coffee towards the end of the season. This year cases have come to notice of buyers mixing good and bad coffee together after they have purchased it from the natives. In order to stop this, and also to improve the preparation of the coffee for the market, efforts are being made to arrange for coffee buying markets for the 1928 season.

During the year, eight new pulping machines were erected and working in North Bugishu and two in South Bugishu. Of these, two in each county were erected by the Native Administration and the others are owned by Chiefs. There are now ten machines working in North Bugishu (one Departmental, two Native Administration, and seven owned by Chiefs), and three in South Bugishu (one Departmental and two Native Administration). More machines are needed and the Native Administration proposes to supply a machine for each Gombolola in the coffee districts, as funds permit, and the urgency for such provision becomes apparent. Records of the coffee cherry pulped are available only for the Departmental machines at Buwalasi and Bubulu. At Buwalasi 102,555 lbs. of 'cherry' were pulped, and at Bubulu 41,532 lbs., as compared with 80,280 and 18,082 respectively for 1926.

'Leaf Disease' was prevalent at lower altitudes, and the 'coffee berry-boring beetle' was rather noticeable in the Siroko Valley. This also seems restricted to lower altitudes. 'Stem boring beetles' have been met with in a few districts but they are mostly in old trees which are past their best. The 'coffee bug' has not been much in evidence. Generally speaking, the trees are remarkably healthy and free from pests and diseases, but careful watch is being kept and two native instructors were sent to Kampala for a course of special training under the Entomologist."

In other parts of the Protectorate *Coffea robusta* is the variety encouraged, and good types of seed have been selected by the Department of Agriculture. Large numbers of nurseries have been established in Buganda Province and elsewhere, as centres for the distribution of plants to native growers. It is estimated that the area under native grown *Coffea robusta* is approximately 2,835 acres.

Pending the appointment of a new Botanist, this work has been under the care of Mr. E. G. Staples, Superintendent of Agricultural Education, and his report is given below :—

"General Organisation.—This industry, already established by Mr. Maitland, the late Botanist, has expanded considerably during the year. As in 1926, the demand for plants has exceeded the supply of selected seed available. With the exception of the Masaka District and a part of Mubende District the sowing of the seed has been confined to the following three centres, *viz.* :—

The Government Plantation, Kampala ;
The Government Plantation, Bukalasa ;
The Botanic Gardens, Entebbe ;

as it is considered that better results are obtained by having the germination of the seed done under the direct supervision of the European staff of the Department.

Out-Nurseries.—A large number of out-nurseries are fed from these three centres. The coffee areas based on them are under the charge of eight trained native instructors. These men, with the exception of the one from Sese, report at Kampala at the end of each month ; they are responsible for the upkeep and stocking of the nurseries, the distribution of seedlings and, as far as possible, the instruction in the proper cultivation of *robusta* coffee by the natives in their respective areas.

Distribution of Seedlings to Native Cultivators.—The following numbers of seedlings were distributed during the year :—

					<i>Plants.</i>
Mengo District	...	...	...	...	38,400
Entebbe "	...	...	...	...	49,700
Mubende "	...	...	...	...	106,500
Masaka "	...	...	...	...	150,000
			TOTAL	...	344,600

In addition to this, 642 lbs. of selected seed was issued to other provinces, to neighbouring Governments, and to European planters.

The following numbers of plants, available for distribution during the spring rains of 1928 were growing in the nurseries at the end of the year :—

Entebbe District, including the Sese Islands...	...	...	214,000
Mengo District	...	...	224,000
Mubende District	...	...	73,000
Kampala nurseries	...	...	57,000
Bukalasa nursery	...	...	25,000
TOTAL			593,000

Inspection.—The inspection, both of the nursery work and of the areas of coffee planted, has been undertaken by all members of the staff available. A considerable amount of the area planted has been visited during the year, either by the Agricultural Officers, or by the Coffee Officer, and the nursery work and distribution have been constantly watched. Officers of the scientific staff have visited or toured areas when disease was suspected.

Pests and Diseases.—These are referred to in the Annual Reports of the Entomologist and Mycologist.

Seed Selection and Supply.—As stated above, the chief difficulty in connection with the industry has been the provision of a sufficient quantity of seed of a good type. Good trees are comparatively few and are widely scattered throughout the Province; these trees have been searched for, and the crop purchased; in many cases they are the progeny of selected seed originally obtained from this Department, so the pedigree was often known. In this connection it is interesting to note that the Coffee Officer has reported that there is a comparatively large amount of a particularly good type of *robusta* coffee now coming into bearing in the Buddu Saza of Masaka District, all the progeny of selected seed from Kampala. This district should now be practically self-supporting in the matter of seed.

It will be seen that seed selection on a scale commensurate with the present demands of the industry involves a very large amount of time and travelling; and although every opportunity of searching out possible sources of really good seed has been taken by the Agricultural Officers, the Coffee Officer and myself, the ever-increasing demand for selected *robusta* seed, on the part of the native population, European planters and of individuals and Governments of neighbouring countries, has created a void which it has been possible only partially to fill."

(c) *Coffee Exports.*—The exports of coffee from the Protectorate during the year amounted to 43,514 cwts. valued at £170,407, compared with 33,211 cwts. valued at £147,884 in 1926.

Rubber.

6. The cultivation of rubber (*Hevea brasiliensis*) is confined almost entirely to European plantations, but there has been no increase in acreage in recent years, and the total area remains at approximately 11,828 acres.

The exports in 1927 showed an increase, and amounted to 14,463 centals of 100 lbs. compared with 13,561 centals in 1926. Owing to the decline in the value on the home market, the total export was valued at £82,077 against £135,619 for the previous year.

An officer of the Department proceeded to Ceylon in September, to study methods of rubber cultivation and preparation in that country.

Tobacco.

7. As far back as 1907 a tobacco expert was engaged by the Government to develop this industry, but nothing of a permanent nature was achieved. In 1913 an effort was made to induce one of the large tobacco companies to begin operations in Uganda, but without success. From that time, however, small experimental areas have been grown, particularly on the Government Plantation at Serere, and the results obtained justified further steps being taken to establish a local tobacco industry.

Experimental work was started in the Bunyoro District in 1927 and has given very promising results. Increasing interest is being shown in this crop by both European and native planters and, if progress is maintained on present lines, there is every indication that tobacco cultivation is likely to play an important part in the development of the country.

Mr. Philpott, Plantation Manager, who visited Nyasaland in 1926, has been in charge of the work, and his report is given on page 22.

A consignment sent to England has been favourably reported upon by the brokers, and the price of one shilling and eight-pence three farthings per lb. which was realised can be looked upon as being very satisfactory.

The following extracts from commercial reports are quoted :—

“ We like the general character of these tobaccos, the colour and flavour being particularly good, though, in future seasons, the growers should try to obtain more body and gum.”

“ We like the flavour of the tobacco and the burning is good. We would advise you to pack this tobacco with 14% moisture content ; as below this percentage the nature of the tobacco will cause breakage and smalls, and above 14% manufacturers are liable to make claims for excessive moisture.”

“ The texture is inclined to be a little woody, but provided the leaf contains gum this is not a serious defect.”

A report by the Imperial Institute on tobacco from Uganda will be found in Appendix No. 1.

Miscellaneous Crops.

8. (a) *Sugar*.—Amongst miscellaneous crops which figure in the export list, priority must be given to sugar. The sugar factory established in 1925 at Lugazi, between Kampala and Jinja, is well equipped and capable of manufacturing 4,000 tons of sugar per annum. The factory is now being enlarged to increase the capacity to 5,000 tons. A local market in Uganda and Kenya is available for the whole of the present output, but during the year 10,161 cwts. valued at £16,371 were exported to other territories.

In connection with this sugar factory, a distillery has been erected and is producing large quantities of power alcohol for local consumption, whilst 638 gallons of methylated spirits were exported.

(b) *Rice*.—The cultivation of this crop on a large scale is practically confined to three districts in the Eastern Province. The bulk of the crop finds a ready market locally, but the natives themselves also rely on it to a large extent as a reserve food supply as, when stored in the husk, it keeps sound for a considerable period.

The following figures show the approximate acreage planted in 1927, together with figures for the two previous years :—

		1925		1926		1927
		<i>Acres.</i>		<i>Acres.</i>		<i>Acres.</i>
Bugwere District	...	400	...	2,000	...	2,000
Bugishu ,,	...	880	...	4,800	...	4,300
Budama ,,	...	9,715	...	10,000	...	2,100
TOTALS	...	10,995	...	16,800	...	8,400

Climatic conditions for rice cultivation were most unfavourable, and the crop was poor. The bulk of the crop was reserved for seed, and the margin available for sale was very small.

(c) *Tea*.—The area under tea has increased from 188 to 246 acres, and the prepared product finds a ready sale locally and in Kenya. The cultivation of this crop is confined to a few European estates and to the plantations under the control of this Department. Natives are now taking an interest in tea and a number of plants were distributed during the year.

(d) *Sim-sim*.—Exports increased to 718 tons valued at £13,732 compared with 194 tons valued at £4,130 in 1926. The increase in the quantities exported is accounted for by the comparatively low prices realised for cotton. In a normal year the natives are not anxious to sell sim-sim provided they are able to realise sufficient cash from cotton to satisfy their current requirements.

(e) *Chillies*.—A marked rise in prices at the end of the year caused renewed interest to be taken in this crop but, owing to the low prices which had prevailed for some time previously, the crop had been neglected and only comparatively small quantities were available. Picking is particularly tedious, and in normal years the natives prefer to rely on cotton and other crops.

(f) *Maize*.—Improved varieties of maize were introduced into the Busoga District of the Eastern Province in 1926. Plots were laid out under the supervision of the Agricultural Officer and in 1927 the resultant crop was re-distributed as seed in areas bordering on the route taken by the new railway. Increased production, combined with low railway freights, should make it possible for Uganda to export considerable quantities of maize, and in some areas to produce maize flour to compete with the imported product.

Seed was also sent to the Bugishu District in the foothills of Mount Elgon and the crop from this will be utilized for wider distribution in 1928.

(g) *Wheat*.—This crop is cultivated on a small scale in the Toro District, but is utilized mainly for local consumption and there is no export.

Government Plantations.

9. The principal experimental plantations are those situated at Kampala and Bukalasa, in Buganda, and Serere in the Eastern Province. Subsidiary stations are also maintained at Fort Portal in the Western Province, Kakumiro in Buganda; Simsa, Bugusege, and Ngetta in the Eastern Province. The last-named plantation is maintained by the Native Administration, but all the experimental work, etc., is under the direct control and supervision of this Department.

The following extracts from reports by the Officers-in-charge of several of the plantations are quoted. The report by Mr. R. G. Harper, Senior Agricultural Officer, on Serere Plantation, will be found on page 17.

(a) BOTANIC GARDENS, ENTEBBE.

The gardens were in charge of Mr. C. Hazel until the end of June, from which date Mr. E. A. Ruck resumed charge on return from leave.

Weather.—Weather conditions have been rather trying throughout the year, the total rainfall of 53·73 inches being below normal, whilst the temperatures recorded were rather higher than usual.

Rubber.—Of the experiment with the Bosch *versus* Burgess tapping knives, it may be concluded that the apparent superiority of one knife over the other depends on the type to which the tapper has previously been accustomed.

Cacao.—Pod production from all the plots was exceedingly low in comparison with previous years' records. This is partly due to the unfavourable weather conditions throughout the year and also to a large extent to an increase in the number of monkeys which destroy the pods when nearly ripe.

Coffee.—55,000 *Coffea robusta* seedlings were raised during the year and distributed in the Entebbe District as follows :—

Mbale	...	...	...	...	10,000
Gomba	...	...	...	...	30,000
Busiro	...	...	...	...	15,000

Oil Palms.—A plantation of oil palms, *Elaeis guineensis*, containing about 260 trees, which was under the charge of the Forestry Department, was handed over to this Department at the end of October.

The palms, which were planted in 1921, have done exceedingly well and at present 45 of them are bearing fruit. These palms have all been labelled and individual records of the yields, etc., are now being commenced.

A consignment of 3,000 selected seeds was received in November from the Buitenzorg Experimental Station, Dutch East Indies, and before sowing in the nursery was treated for early germination.

Hydnocarpus Wightiana.—Numbers of plants of *Hydnocarpus* were raised in the nursery during the year, of which 590 were handed over to the Conservator of Forests, 100 forwarded to the Agricultural Officer, Fort Portal, and 36 planted out in the gardens in June. Of the latter, all the trees have become well established and are making good progress.

Introduction of Plants and Seeds.—Ninety-seven packets of seed were received during the year and thanks are due to the following for their contributions :—

Director, Botanic Station, Brignoles, France.
 Director of Agriculture, Barbados.
 Director of Agriculture, Manila, P. I.
 Director, Horticultural Section, Giza, Egypt.
 Regius Keeper, Royal Botanic Garden, Edinburgh.
 Prof. Juan Balme, F.R.H.S., Mexico City, Mexico.

Distribution of Plants and Seeds.—The number of requests for fruit trees during the free distribution in April was 28, when 2,891 fruit trees were distributed. There was a big demand for decorative plants during the year as will be seen from the table given below :—

PLANTS.				SEEDS.		LAWN GRASS.
Economic.				Economic.	Decorative.	Bundles.
<i>Coffea robusta</i>	...	...	55,000			
<i>Hydnocarpus Wightiana</i>	...	...	690	29 Pkts.	268 Pkts.	11
Various	...	...	3,147			

(b) KAMPALA PLANTATION.

The work at this station is confined mainly to experiments in connection with investigations at the Agricultural Laboratory and agricultural education. The bulk of the field work has been transferred to the plantation at Bukalasa, where conditions for crop experiments are generally more favourable.

The distribution of plants and seeds was as follows :—

ECONOMIC.						DECORATIVE.	
<i>Coffea robusta.</i>			Tea.	Various.		Various.	
Plants.	Seedlings.	Seeds.	Seed.	Plants.	Seeds.	Cuttings.	Seeds.
32,475	519,670	643 lbs.	4,200	4,267	55 lbs.	6,439	—

(c) BUKALASA PLANTATION.

Selection work is in progress in connection with all the more important food crops and selected seed is carefully tested against the unselected seed, with due regard to statistical analyses of the results. This work will only yield quantitative results after several years have elapsed.

The following extracts are taken from the Annual Reports of the Agricultural Officer, Mr. N. S. Haig, and the Plantation Manager, Capt. J. S. Harmsworth, M.C. :—

"Cotton.—Climatic conditions have been unfavourable during the year ; prolonged hot and dry weather during the planting season and the lateness in planting will, to some extent, nullify the experimental results. The June sowing made excellent growth, but was considerably damaged by hail and wind.

Food Crops.—The following yields were obtained from food crops harvested during the year :—

Crop.		Variety.		Yield per Acre.	
				Lbs.	
Beans	...	Navy	...	...	950
		Bitango	...	...	703
		Serere	...	...	103
		Kainja	...	...	309
		Mguleganamuyi	...	...	268
		Mutika	...	...	713
		Bitango	...	...	500
		Navy	...	...	600
Mpinde	...	Canadian	...	...	793
		Rhodesian	...	...	609
		Ordinary	...	...	609
Mpokya	...	Black	...	...	769
		Green	...	...	663
Sim-sim	...	...	...	...	555
<i>Sorghum Barbuda</i>	...	...	...	...	1,508

Bananas.—Twenty-four of the native varieties of bananas repeated five times, were put in during the year.

An experiment to test the local method of planting bananas against the Jamaican method has been carried out ; each method was repeated five times in sub-plots of 42 stools. At the time of writing the Baganda method has shown a much quicker growth than the Jamaican method.

OTHER CROPS.

Cinchona.—A small quantity of quinine bark was stripped off the trees planted in 1922; the method of obtaining the bark was by coppicing. The report on the bark is given in Appendix No. 3.

Ground Nuts.—Two varieties, the local type and a variety from Serere, were tested in the spring rains. The local type proved to be a slightly heavier yielder and ripened earlier and more uniformly. The Serere type has a lower, spreading habit of growth, and keeps weeds down more efficiently, but is more of a perennial, and continues to fruit at intervals, and consequently does not give an uniform crop.

Yields of the two varieties were as follows:—

	Total Yield of Sub-plots.		Loss in		Estimated Yield per Acre. (shelled) lbs.
	Unshelled	Shelled.	Shelling.		
Local Seed	... 353	... 266	... 25%	...	760
Serere Seed	... 536	... 251	... 53%	...	720

The local variety also gave a better sample, the nuts being slightly larger and of more uniform size than the Serere variety. Two other varieties, Gulu and Small Japan, were being grown in increase plots at the end of the year, and it is intended to carry out a further test with the four varieties in 1928.

Model Small Holding.—An area of three acres has been set aside for settlement by a selected Muganda and his family, with the object of obtaining data as to costs of production, profit or loss, to be expected from a small holding of this size run on good lines, and under a definite rotation.

The holding is divided into four plots, of which one is the permanent matoke (banana) plot with the occupier's house; half of this will be interplanted with *Coffea robusta* during the next rains. The other three plots are cropped under the following rotation:—

1st year	...	Muhogo and sweet potatoes—a full course of one year.
2nd „	...	Sim-sim. Cotton.
3rd „	...	Maize and mtama (interplanted with beans and ground nuts). Cotton.

The occupier is provided with good seed, and has been receiving up to the end of the year Shs. 12 per month until his holding has become established. The payment of a monthly wage enables better control to be exercised in the care of the holding, although it may be found advisable to discontinue this next year, when his crops will be well established.

The erection of a three-roomed house with grass roof and sun-dried brick walls was completed by the end of the year.”

(d) NGETTA PLANTATION.

In his Annual Report the Agricultural Officer, Mr. C. E. J. Biggs, writes as follows:—

“The area of this farm was not extended during the year. It is now a convenient size for the purposes of demonstration and selection work.

Weather conditions were generally dry and unfavourable throughout the year and it was thus possible to demonstrate to the natives that, under such conditions, thorough cultivation will to some extent compensate for the shortage of rainfall.

The yields obtained were not high but they were better than those obtained in the neighbourhood and in Northern Lango generally.

Yields of Food Crops.—

	Lbs. per Acre.			
Bulo	...	...	...	... 1,302
Sim-sim	...	...	...	... 216
Millet	...	...	...	... 1,311 (<i>Sorghum Barbuda</i>).

Cotton 1926-27 Crop.—This was planted late in August owing to the fact that the preparation of the land was delayed. The yield of 212 lbs. of seed cotton per acre was therefore satisfactory when compared with the average for the district.

Cotton 1927-28 Crop.—Twenty-three acres of cotton were planted in four fields between June 1st and August 18th, and in spite of many hindrances such as drought and attacks of cutworm, root grubs, and white ants, all the cotton will give a good yield.

There could be no better demonstration to the native of the value of ploughing, harrowing and general care of the cotton crop.”

Food Crops.

10. (a) *Eastern Province*.—Erratic weather conditions were responsible for the partial failure, which in some cases amounted to almost total failure of the main food crops in all districts of the Province. In Teso and Lango Districts, re-sowings of

the early bulo crops were necessary and, owing to the subsequent dry weather and general unfavourable conditions, yields were low. Other subsidiary crops suffered less severely, and in view of a possible serious shortage of food the natives were encouraged to plant large areas of cassava and sweet potatoes.

(b) *Buganda Province*.—Early sown crops suffered severely during the prolonged dry periods, but good rains towards the end of the year averted the possibility of a food shortage. Conditions were generally more favourable than in the Eastern Province and the position at the end of the year, although not entirely satisfactory, gave no cause for anxiety.

(c) *Northern and Western Provinces*.—The conditions were much the same as in Buganda, but drought during the early part of the year adversely affected the yield of all crops, particularly in Chua and parts of Gulu.

Ploughing.

11. The use of ploughs by native cultivators is confined mainly to the Teso, Lango, and Bugwere Districts of the Eastern Province. Ploughing schools are maintained by this Department at several centres, where natives are trained in the breaking and care of oxen and the handling of the plough.

In Teso District, owing to the lower prices obtained for cotton, money was scarce, and consequently sales of ploughs were lower than usual. The total number of ploughs in use in the district in 1927 was 2,941, as compared with 2,710 in 1926.

Good progress was made in Bugwere District, and the approximate number of ploughs in use was 1,275.

Owing to the dried-up condition of the country, the work of ploughing has been severely handicapped, but under normal and more favourable conditions there is every prospect of an increase in the use of these implements.

Agricultural Education.

12. The report of the Superintendent of Agricultural Education is given on page 26.

Two systems of agricultural education are in operation in Uganda. The Superintendent of Agricultural Education works in the closest co-operation with the Department of Education and the various Missions, with the object of obtaining for agricultural science and practice a definite place in all educational work. In addition to this, practical instruction and training is carried out on all Government plantations. In connection with the new laboratory and the Kampala Plantation, it is hoped to start a Farm School for pupils who are the sons of small working landowners. These pupils will be carefully selected and will be trained in the work and management of a small farm, so that they may apply their knowledge in the development of their own land.

Mr. R. G. Harper, Senior Agricultural Officer, reports on work done at Serere as follows:—

“During the past year there were seventy-three voluntary entrants of lads from Teso and adjoining districts for training in agricultural practice. Only thirty-nine of the best were enrolled and they have made satisfactory progress.

In all, over two hundred lads have been trained on Serere Station since the work was inaugurated in 1924. A number of the best pupils have been appointed instructors and some of these are doing really good work in the districts; others are employed as field observers by the Cotton Botanist, and the remainder return to their homes where it is hoped they will continue to practise what they have learnt at the Experimental Station.”

Agricultural Chemistry.

13. The Agricultural Chemist was absent from the Protectorate until October. During his leave he attended the First International Congress of Soil Science in the United States of America, and a complete report has been published elsewhere.

A short Annual Report will be found on page 42.

Entomology and Mycology.

14. The reports of the Entomologist and Mycologist are included in this publication, and give full details of the work done during the year.

Cotton Selection.

15. The Cotton Botanist returned from leave on April 14th, and resumed work at Serere Experimental Station. A report will be found on page 28.

Imperial Agricultural Conference.

16. This Conference was held in England from October 4th to November 3rd, and was attended by Mr. A. B. Killick, Agricultural Officer, as delegate from Uganda.

Agricultural Statistics.

17. Full details will be found in the Appendices at the end of this report.

Meteorological Returns.

18. Owing to the increasing volume of the meteorological tables, it has been considered advisable to publish them in a separate bulletin and they are not, therefore, included in this report as in previous years.

The meteorological map attached to this report has been compiled from statistics supplied by this Department, and thanks are due to Mr. F. C. MacDonald, Chief Draughtsman in the Land and Survey Department, for his work in this connection.

Agricultural Laboratory.

19. The new buildings were practically completed and were occupied by the Scientific Staff towards the end of the year. A photograph of the building is included in this report as a frontispiece.

The Public Works Department is to be congratulated on the work done in building and equipping this laboratory.

Staff.

20. Several changes took place during the year, but at the time of writing this report all vacancies have been filled.

I desire to record my appreciation of the services rendered by all members of the staff during the year.

S. SIMPSON,
Director of Agriculture.

ANNUAL REPORT ON SERERE EXPERIMENTAL STATION.

By the Senior Agricultural Officer.

Results of Cotton Crop, 1926.

The following table gives the results of the main areas at a glance :—

Selection No.			Area. Acres.	Total Yield.	Yield per Acre.	Ginning %	Remarks.
N. 19	...	...	12	3,527	294	30·6	Plants thinned out by root disease.
N. 6	...	...	8	3,881	485	29·2	
N. 24	...	...	5	1,254	251	30·4	
N. 32	...	...	2	416	208	30·9	Late sown and much damaged by hail.

The above cotton was ginned by Messrs. The Bombay Uganda Co., Ltd., at their Rappayi ginnery, who kindly conducted careful ginning tests. They also baled and forwarded to England the samples N. 19 and N. 6, under distinctive marks, and received the following Broker's report :—

N. 19.—2 bales. Value 14·40d. Very clean and bright staple 1·3/16th.

N. 6.—2 bales. Value 13·90d. Bright, fairly clean. Staple full 1·1/8th.

Based on August American Futures 9·90d.

It was decided to sow the 1927/28 main crop on Serere Station with N. 19, as well as a segregated area at the Achuna ginnery.

Year 1927—Labour.

There was no difficulty as regards the labour supply during the past year; in fact most months the supply exceeded the demand.

There was also a great improvement in the attendance of porters from previous years, which contributed largely towards the success of the year's work on the Plantation.

Cotton Crop.

1. *Main Crop*.—As stated above, type N. 19 was sown as the main crop—an area of 25 acres. This was sown under good conditions in July and early August.

Germination was fairly good and the crop made good progress in spite of dry conditions.

The advantages of deep initial cultivation and soil mulching during the dry spells were distinctly obvious during the past year of low rainfall, and all visitors to the Plantation were impressed thereby.

The initial bolling was good and the dry autumn induced rapid maturity and an unusually heavy first picking yielded approximately 300 lbs. per acre.

The secondary bolling was less profuse and it seems probable that rather more than half the crop had been picked by the 31st December. The crop has been unusually free from pests and diseases of all kinds and in consequence the amount of second quality cotton is low.

2. *Increase Plots*.—Three selections by the Cotton Botanist were sown in segregated areas, viz.:—

							<i>Acres.</i>
S. G. 29	...	...	...	...	...	...	7
S. G. 15	...	...	...	...	...	...	3
S. G. 26	...	...	...	...	...	...	2
							12

These were sown in July and August and, although the plants have not made large vegetative growth, bolling has been profuse and heavy yields have already been picked from all of them.

Interesting results are to be expected, and the determination of the most suitable selection for future distribution will be decided when the reports on the spinning tests have been received.

3. *Varietal, Spacing and Date of Sowing Tests*.—Tests are being carried out by the Cotton Botanist on similar lines to those of last year. These cover several acres and are expected to yield interesting results.

Food and Other Crops.

Experimental work on native food and other crops was continued on a more comprehensive scale than in previous years, the main object being to establish pure lines out of the very mixed types used by natives, in order to increase the quality and yields of such crops. At the same time tests as to the rate of sowing, etc., were carried out.

The following is a summary of the results obtained from the different crop experiments:—

A. WIMBI CROP (*Eleusine coracana*).

1. *Varietal Trial*.—Four distinct varieties selected and segregated from the native crop: one-quarter acre plots.

<i>Plot No.</i>		<i>Native Name.</i>			<i>Yield per Acre.</i>
1	...	Emiroit	...	...	<i>Lbs.</i> 104
2	...	Eteke	...	...	300
3	...	Engenyi	...	...	1,528
4	...	Emoru	...	...	1,804

Plots Nos. 1 and 2 were spoiled by a heavy storm after sowing, and much of the seed was lost.

2. *Rate of Seeding Trial*.—Var. Eteke. Eight plots 1/16th acre each. Sown 12th February. Harvested 21st June.

<i>Rate.</i>		<i>Yield per Acre.</i>	<i>Rate.</i>		<i>Yield per Acre.</i>
<i>Lbs. per Acre.</i>		<i>Lbs.</i>	<i>Lbs. per Acre.</i>		<i>Lbs.</i>
4	...	1,024	12	...	992
6	...	3,104	14	...	1,392
8	...	2,432	16	...	1,824
10	...	1,536	18	...	1,072

Although not conclusive, the above figures indicate the superiority of moderate seeding.

3. *Comparison of Yield of Wimbi*.—(a) After Fallow, and (b) after Cotton.

After Fallow	...	...	...	...	<i>Lbs.</i> 1,078
After Cotton	...	...	...	...	2,270

The Fallow plot was ploughed in autumn and left rough until the time of sowing on 15th February, when the pulverising harrow was used to produce a fine tilth. The seed was harrowed in.

The Cotton plot was sown native-fashion after the stalks had been removed on the same date. The superiority of the cotton plot was entirely due to freedom from weed-seeds, the Fallow plot being choked by grass.

4. *Effect of Manuring with Cow-dung on Wimbi*.—Var. Emirot. Plots 1/8th acre. Cow-dung applied at the rate of 10 tons per acre.

						<i>Lbs. per Acre.</i>
Manured	...	...	...	...	...	1,008
Unmanured	...	...	...	...	...	992

5. *Progeny Plots*.—1/15th acre in size. Twenty-five individual selections made on previous year's crop.

These gave successful results and yields up to 2,500 lbs. were obtained.

The seeds of the four main varieties selected in 1925 will be available for distribution in the district in 1928.

B. MAIZE CROP (*Zea Mays*).

1. *Increase Plots*.—Three distinct varieties—Hickory King, Potchefstroom Pearl, and Salisbury White. Plots, half-an-acre. Sown 22nd March. Reaped 12th July. Spacing 1 ft. 9 in. by 1 ft. 9 in. 4 lbs. seed per acre.

<i>Yields per Acre in Cobs.</i>						
	...	...	<i>Lbs.</i>	...	...	
Hickory King	...	...	2,320	...	...	A thin plant.
Potchefstroom Pearl	...	...	2,536	...	...	Damaged by ants.
Salisbury White	...	...	2,940	...	...	—

2. *Effects of Lime on Maize Crop*.—Var. Hickory King. Plots 1/8th acre. Lime applied at rate of 1,600 lbs. per acre on 23rd March. Maize sown same day. Spacing 1 ft. 9 in. by 1 ft. 9 in.

<i>Yields per Acre in Cobs.</i>						
	...	...	<i>Lbs.</i>	...	...	
Limed	...	...	...	...	...	2,912
No lime	...	...	...	...	...	2,840

3. *Rate of Seeding Trial*.—One seed and two seeds per hole.

<i>Yields per Acre in Cobs.</i>						
	...	...	<i>Lbs.</i>	...	...	
1 seed per hole	...	...	...	...	...	1,664
2 seeds „	...	...	...	...	...	1,624

The cobs in the two plants per hole were very small and the sample below average.

4. *Individual Selections*.—Selections made from crop of Hickory King in 1926, with two cobs per plant, were sown in progeny rows and interesting results were obtained for further trial.

5. *Spacing Test*.—Four spacings in plots one-quarter of an acre each.

<i>Plot No.</i>	<i>Spacing.</i>				<i>Yield per Acre in Cobs.</i>	
	...	...	...	...	<i>Lbs.</i>	
1	...	...	1' 6" × 1' 9"	...	...	4,316
2	...	...	1' 9" × 1' 9"	...	...	2,500
3	...	...	1' 9" × 2' 0"	...	...	3,276
4	...	...	1' 9" × 2' 3"	..	...	3,712

Plots 2, 3 and 4 were damaged badly by white ants, which rendered the test inconclusive.

C. SIM-SIM CROP (*Sesamum indicum*).

1. *Progeny Plots*.—Sixteen different types, including individual selections from local native crops with a number of imported types for comparison.

<i>No. 1.</i>	<i>Local type</i>	...	...	...	...	<i>Yields per Acre.</i>	
		...	...	...	...	<i>Lbs.</i>	
2.	„	„	...	...	...	350	
3.	„	„	...	...	...	600	
4.	„	„	...	...	...	250	
5.	„	„	...	...	...	800	
6.	„	„	...	...	...	350	
7.	„	„	...	...	...	250	
8.	„	„	...	...	...	350	
9.	„	„	...	...	...	100	
10.	„	„	...	...	...	600	
11.	„	„	...	...	...	600	
12.	Gulu type	...	...	...	...	500	
13.	„	„	...	...	...	200	Ladongo, big pod.
14.	„	„	...	...	...	100	Latino, small pod.
15.	Atura	„	...	...	...	600	Gure.
16.	Bukumbi	„	...	...	...	350	
			...	...	...	400	

2. *Increase Plots*.—Four types selected in 1925. Plots one-quarter of an acre. Sown 7th April.

No. 1.—Yield	456 lbs. per acre, reaped	21-7-27.
2.— „	240 „ „ „	8-7-27.
3.— „	188 „ „ „	28-7-27.
4.— „	268 „ „ „	29-7-27.

All plots were attacked by a species of Gall Midge (*Cecidomyidæ*) on the pods, which reduced the yields considerably.

An area of $1\frac{1}{2}$ acres was sown with ordinary seed for food purposes and yielded at the rate of 250 lbs. per acre.

D. MTAMA OR TALL MILLET (*Sorghum Sp.*).

1. *Varietal Trial*.—Three Vars. Native White, Native Red and Imported Black. (*Sorghum Barbuda*).

Yields per Acre.			
		Lbs.	
1. White	...	1,692	Harvested 25-7-27.
2. Red	...	2,548	„ 23-7-27.
3. Black	...	1,624	„ 7-7-27.

An area of two acres was sown in August with seed of the Red variety, but this succumbed to the dry weather in August and was a total failure.

E. GROUND NUTS (*Arachis hypogæa*).

1. *Lime Manuring Trial*.—Rate of application—2,000 lbs. per acre.

(a) *After Grass Lea*.—Var. Local. One-quarter of an acre plots. Seed sown in rows at rate of 30 lbs. per acre. Sown 9th April and harvested 10th August.

Yield per Acre.			
Limed Plot	...	...	816 lbs. unshelled.
Unlimed	...	...	400 „ „

(b) *After Grain Crop*.—Conditions as above.

Yield per Acre.			
Limed Plot	...	...	528 lbs. unshelled.
Unlimed	...	...	520 „ „

(c) *Broadcasting v. Sowing in Rows*.—An area of about half-an-acre was sown on land (after grass lea) adjoining the above plots. The seed was broadcasted native-fashion at the rate of 100 lbs. per acre.

Some interesting observations were made during the period of growth in reference to the incidence of Rosette disease and it was noticed that in the broadcasted plot, with close spacing, the crop was comparatively free from the disease, whereas on the plot sown in rows, with wider spacing, the crop did not cover the ground so quickly and the disease was prevalent on all the plots.

The application of lime had but a limited effect on the disease but a heavier application would probably have given more definite results.

The yield from the plot was at the rate of 960 lbs. unshelled nuts per acre.

The native peasants' contention that close spacing is necessary appears to be a sound one, but their contention that a successful crop can only be obtained from newly broken land requires further elucidation.

A small increase plot of the small Japan variety was remarkably free from disease and gave a good yield.

F. BUCKWHEAT (*Fagopyrus esculentum*).

1. *Rate of Seeding Trial*.—To determine optimum rate. Plots $\frac{1}{8}$ th acre. Six different rates of seeding, as under. Sown on 26th April and harvested on 27th June.

Plot No.	Per Acre.				Yield.
		Lbs.			Lbs.
1	...	20	...	...	336
2	...	28	...	...	336
3	...	36	...	...	488
4	...	44	...	...	520
5	...	52	...	...	1,136
6	...	60	...	...	1,184

A trial was carried out in the previous year with somewhat similar results.

G. BEAN CROP (*Phaseolus sp.*).

Variety Trial.—Twenty-one different types, comprising many native types from different parts of the country and some importations, to determine those varieties best suited to the soils and

climate of Teso. Plots 1/10th acre. Sown 2nd August in rows. Spacing 1 ft. 3 in. by 1 ft. 3 in. Harvested 11th October.

YIELDS PER ACRE.					
No.		Lbs.	No.		Lbs.
1	...	30	11	...	100
2	...	70	12	...	20
3	...	200	13	...	280
4	...	180	14	...	290
5	...	90	15	...	240
6	...	160	16	...	130
7	...	10	17	...	70
8	...	270	18	...	130
9	...	270	19	...	170
10	...	150	20	...	270
			21	...	70

Some of the plots were badly affected by a wilt disease identified by the Mycologist as being probably *Fusarium Martii*, var. *Phaseoli*, which accounts largely for the low yield.

Variations in quality of soil also no doubt had an appreciable effect. Numbers 3, 4, 6, 8, 9, 13, 14, 15, 20 and 21, which shewed more robust growth and freedom from disease than the others, will be retained for further trial.

2. A one-acre plot of White Navy Bean, sown on the 4th August and reaped on the 11th October, yielded 300 lbs. The *Fusarium* disease referred to above caused considerable damage to this plot.

3. A one-quarter acre plot of Canadian Wonder bean, sown broadcast on 5th August and reaped on 24th October, yielded 100 lbs.

H. MPINDI CROP (*Vigna* sp.).

1. Several species of native Mpindi were sown in plot trial. One of these, Bimogoti, introduced from Buganda Province, gave excellent results as regards robust growth, resistance to drought and disease, and yielded at the rate of 385 lbs. per acre. This variety would be most useful as a cover crop as well as for green manuring purposes.

Other varieties were seriously affected by the drought and only small yields were obtained.

I. SWEET POTATOES.

An area of four acres was planted in ridges made by the plough in August. The crop suffered from an attack by caterpillars in October, when all the leaves were eaten, as well as from dry spells of weather and, in consequence, only a moderate yield will be obtained.

J. TOBACCO.

Two varieties from seed of original stocks were grown in one-quarter acre plots. These proved successful.

K. NURSERY.

Approximately 600 seedlings (chiefly fruit), together with quantities of seeds of various descriptions, were distributed free during the year.

The temporary shade over the beds was replaced by a permanent structure made of ensambya poles and reeds, which should last for several years.

L. LIVE STOCK.

During the year no epidemics occurred among the cattle, but eight died from various causes. They were all inoculated for pleuro-pneumonia.

Forty head of young bulls were purchased early in the year at a cost of about Shs. 25 each. These were inoculated and castrated.

M. GENERAL.

Two demonstrations were held, the first on 4th June and the second on 10th October, both of which were attended by a large number of Chiefs and others, who displayed much interest in the experimental work being carried out.

Amongst distinguished visitors to the station, H. E. The Governor visited Serere in May, Mr. Bottomley of the Colonial Office in March, and the Director of the Amani Institute in August.

Extensions to permanent buildings consisted of the completion of permanent quarters for pupils and the addition of a third room to the Botanical Laboratory.

R. G. HARPER,
Senior Agricultural Officer.

TOBACCO.—EXPERIMENTS IN BUNYORO.

The experiments at Bulindi were confined to the heavy types of tobacco suitable for fire-curing and which might be successfully grown and cured by natives.

Experiments with flue-curing cigarette tobacco were carried out on an European plantation near Masindi and also on some land near Hoima.

At Bulindi two acres of land were selected near the Hoima—Masindi road and the work of clearing and opening up the land was commenced at the beginning of February.

Bulindi was selected as a suitable place to carry out the work, as it is a fairly large centre for natives and it was hoped that they would take some interest in the work and benefit by this demonstration of the cultivation and handling of the crop in all stages.

That a good deal of interest was taken in the work carried on is reflected by the number of requests received for seed and plants for planting this season.

Nurseries were sown on the 10th February, the seed used being a heavy type of Virginian tobacco obtained from Serere (a type which has been grown there for a number of years) and a South African variety, Piet Retief Swazie, the seed of which came from the Department of Agriculture, Pretoria.

Grass was used for shading and proved quite satisfactory.

An excellent germination was obtained, the young plants showing up well on the seventh day.

With the exception of a slight attack of the stem-borer, *Pthorimaea heliopa*, no trouble was experienced in the nurseries.

The beds were sprayed on three occasions with Burgundy mixture, two beds being left unsprayed as controls. I may mention here, however, that no leaf diseases were observed at any time on either the sprayed or unsprayed plants. This, however, should not be taken as an indication that spraying is not necessary, as several leaf diseases are to be found on plots of native tobacco, and spraying should certainly form a regular part of the work carried out in tobacco nurseries.

The young plants made good progress and were ready for planting out by the middle of April.

Planting had to be suspended on several occasions owing to changeable weather and periods of hot sunshine.

The main planting was done on the 21st April. The planting was done on the flat, the plants being spaced 3 ft. by 3 ft.

Weather conditions during May and June were excellent. Growth was rapid and the plants were ready for topping at the end of June.

An average of nine leaves was left on each plant.

Harvesting commenced on the 14th July and was completed on the 25th.

The single leaf method of harvesting was used throughout. The leaf was of good average size, heavy and oily.

Curing was carried out in a grass shed. The whole of the crop was cured by the open fire method and the average time taken to cure and dry out each picking was thirty days.

The cured leaf was of good colour with fair body and texture.

From the two acres planted, 1,490 lbs. of cured leaf was obtained, 800 lbs. of which graded into the first grade (D.L.). The crop would have been heavier but the Serere seed proved to be rather mixed and produced a number of small, rather thin-leaved plants, unsuitable for fire curing.

With regard to the costs of the different operations in connection with the crop, it must be borne in mind that the skill with which labourers handle any kind of work differs considerably, so that costs are a variable factor, even in one locality, and tobacco being an entirely new crop, the labour had to be trained in practically every detail, and the work was naturally slower than with trained labour.

Suckering, an unpleasant job amongst heavy tobacco, proved to be work which the labour disliked more than any other, and it was difficult to get anything like a fair day's work done.

Two hundred yards of nurseries were put in. This was far in excess of the requirements for two acres, the usual yardage being about twenty yards per acre, so that the actual cost of nurseries should be much less. The costs shown against nurseries include opening new ground and preparation of the beds, collection of material for shading, and general upkeep.

The cost of erecting the curing shed, which in this case was 90 ft. long, 16 ft. wide, and 8 ft. high to the eaves, is not included, nor is the cost of opening and preparing the land.

Nurseries	...	...	234 man days	Shs. 73 35
Planting	...	...	20 "	" " 5 50
Inter-cultivation	...	...	91 "	" " 29 00
Priming, Topping and Suckering	...	...	87 "	" " 27 70
Harvest	...	...	101 "	" " 30 97
Curing, Firewood, etc.	...	...	90 "	" " 24 00
TOTAL			...	190 52

The above figures all refer to work in connection with two acres.

Grading and packing costs are not shown as no proper packing facilities were available. The cost would probably be about £8 per ton.

A second sowing was made on the 29th July. Germination was good and no trouble was experienced in the nurseries. Plants were ready for putting out at the end of September.

Unfavourable weather conditions were experienced throughout October, and a large number of plants failed to become established in the field. Owing to the very dry weather, blanks could not be replanted.

November also proved a dry month and growth was very poor. At the middle of December, when the plants commenced to show flower and were topped, they were still small.

Weather conditions were entirely against the second planting and the crop will be a poor one, but there is little doubt that under normal conditions two crops may be obtained during the year.

For the cigarette tobacco, seed was obtained from Nyasaland and was sown on the 15th July. Germination was satisfactory and the plants were ready to put out at the middle of September. Difficult weather conditions were experienced, however, and the main planting was not done until the 10th October.

Growth was rapid and the plants were topped at the beginning of December, an average of twelve leaves being left on each plant.

Harvesting commenced on the 14th December. The leaves were large, and of medium body and weight.

The leaf coloured well in the barn, but difficulty had been experienced in obtaining suitable material for the construction of flues, and the material used proved not strong enough to withstand the heat at the temperature required to finish the curing, consequently operations had to be suspended before the colour was fixed.

Two further attempts were made, using other material for flues, but with no better results, and the experiment had finally to be abandoned for this reason.

This experiment as far as it could be carried through showed great promise of success, and there is little doubt that good coloured yellow tobacco can be grown on our lighter soils.

G. T. PHILPOTT,
Plantation Manager.

ANNUAL REPORT ON ARABICA COFFEE.

By the Coffee Officer.

I have the honour to report on my work since my arrival in Uganda in October, 1926. During this period I was on tour in Toro for six weeks in October and November, 1926, in Kyagwe for about six weeks, in Masaka District four weeks, in Bugishu District four weeks, and Masindi District for three weeks.

During these tours most of my time has been occupied in the inspection of European estates and advice on many questions has been given to planters. The following general remarks on *Coffea arabica* in Uganda are the result of my inspections, and are given here in the hope that they may be of use to planters:—

(1) Nurseries.

On the whole these are kept in a satisfactory condition on most estates.

(2) Planting.

Not enough care has been exercised in the past in the preparation of the holes for planting out the coffee seedlings from the nurseries, with the result that many of the trees show poor growth and considerable die-back, due to the damage done to the roots of the seedlings when planted out in the fields. It is imperative that all the roots of the young plants be set in the soil in a natural manner, and especially that the tap root be not broken or twisted.

On some estates the plants are set too deep in the soil. The soil level in the fields should not be more than two to three inches above that in the nurseries.

Before lining out new fields for planting it is very necessary to decide on the system of pruning to be followed. In the case of the single stem system the best spacing in Uganda seems to be 7 ft. by 7 ft. A spacing of 6 ft. by 6 ft. is good provided that the pruning be carried out properly to keep the trees cut back to prevent over-crowding. Wider spacing than 7 ft. by 7 ft. leaves too much soil exposed between the trees when kept to this system of pruning.

If the Agobiada or multiple stem system of pruning is decided on, wider spacing of the plants is necessary, up to 11 ft. by 11 ft. In the case of the Agobiada the plants can be set out 5 ft. by 5 ft. and afterwards, when the trees become too large for this, alternate plants can be cut out.

(3) Shade.

On some estates *arabica* coffee is planted as a catch crop in the development of rubber plantations. In these cases the spacing of the coffee and the rubber shade will be determined by the latter crop, the coffee being of secondary importance.

On estates developed for the purpose of growing coffee only, the question of the use of shade trees will occur. In my own experience, both in Uganda and elsewhere, I am of opinion that good coffee can be grown here without shade, especially on estates where the single stem system of pruning is practised.

From observations in all the coffee growing districts of Uganda, I have formed the opinion that shade trees can be entirely dispensed with, provided the surface of the soil can be protected from exposure to the sun and to rain wash, and that this protection of the soil is the only type of shade required in the growth of coffee. In other words, the essential requirement of coffee estates in the matter of shade is the shading of the soil as opposed to overhead shading of the coffee.

On many estates shade trees have been planted much too thickly; especially is this true of Toro district as a whole, with consequent reduction of the crop obtained from the coffee.

(4) Cultivation.

In the past the whole idea of coffee cultivation in Uganda has been to keep the field free from every kind of weed. The result has been that, owing to the consequent exposure of the surface soil to the ravages of the sun and rain wash, many fields have deteriorated to such an extent that they have now been completely abandoned. A most remarkable fact is that although some planters have realised the bad effects consequent upon such a system of clean-weeding fields, many others are still carrying on the same system.

It has been very forcibly impressed upon me that the two chief agencies to be fought against in the cultivation of coffee in Uganda are the sun's rays and rain; and that a system of cultivation must now be devised to deal with these in a more satisfactory manner than the present system of clean-weeding.

The following alternative systems are now being tried out in various districts, though in the absence of experimental work it cannot yet be proved which is the best. In this connection it is hoped during the next few months to lay down experiments based on the various methods outlined below:—

(a) *A system of leguminous cover cropping.*—At the present only two or three crops are available to coffee planters, which promise to be at all useful. These are the ordinary native “Mpindi” (*Vigna catiung*) and the Rhodesian Cow Pea (*Vigna sinensis*). The former should be sown thickly in the fields and allowed to grow until the first seeds are ripe. If dug in at this time, the crop will resow itself and so save considerable labour.

The Rhodesian Cow Pea is a more spreading plant, and should be planted 18 to 24 inches wide and treated in the same way as described above.

Under such a system as this the soil is protected from the sun for a considerable part of the year, and the humus added by digging the cover crop into the soil will have a beneficial effect on the coffee.

(b) Another simple method of protecting the soil from the sun is to allow the growth of the ordinary weeds in the fields, and to hoe these two or three times a year only with a single annual digging or cultivating between the rows of coffee.

(c) On all estates planted on slopes it is imperative that a system of contour “drains” be put in from the start, to prevent the removal of the surface soil by the heavy rains occurring so frequently in Uganda. The present system employed on some estates of planting lines of lemon grass along the contours to stop wash is certainly better than no provision at all against wash, but this grass is not a success in coffee estates as it tends to impoverish the soil.

On some estates a system of catch pits has been used, but in these cases the soil tends to become heaped around the roots of the trees, with detrimental effects, whilst the catch pits become filled with water and in rainy weather the soil in them becomes water-soaked.

(5) Pruning.

Planters have stated that up to a few years ago all coffee estates in Uganda were run on the single stem system. Of late years, however, the majority have converted their trees to a bush system, either Agobiada or multiple stem. Several of these planters now admit that though for the first few crops after the conversion a general improvement of crop results, afterwards the crops fall off, and finally are inferior to those obtained from the old single stem system.

Very few planters have grown coffee in Uganda on the single stem system using the correct method of pruning, with the result that they have become prejudiced in favour of the bush systems, which require considerably less expert pruners and less labour to run the estates. Latterly, however, I have been able to induce some estates to give a fair trial to the single stem system, using the proper West Indian methods of pruning, under close supervision.

Some of these estates report that a considerable increase in crop has resulted, and are now quite converted to this system.

The native labour used in pruning these estates has proved on the whole very efficient in learning and applying the new pruning methods.

I am strongly of opinion that many estates have converted their trees to Agobiada and multiple stem systems without having first given each system a proper trial, and that they would have done considerably better to adhere to the single stem. I hope to be able to get at least one planter in each district to run an experiment on the different pruning methods to serve as a demonstration plot to the other planters of the district, and from which they will be able to draw their own conclusions.

(6) Picking the Crop.

All coffee should be picked as soon as ripe before the cherries reach a dark red colour. Towards the end of the crop a number of fruit are left on the trees which will never ripen properly. These should all be stripped off, and not allowed to remain on the trees to dry into "buni."

In some seasons *arabica* coffee is liable to bear so heavily that the trees are not able to support the crop and ripen it properly. At the first sign of weakness on the part of the trees, shown by the dropping of the leaves and the commencement of "die-back," the coffee, as soon as it reaches a yellow colour, should be stripped off to relieve the trees, when it will be found possible to pulp it. The green part of such a crop should be stripped off and dried as "buni." Much of the "leaf disease" (*Hemileia*) and "die-back" formerly considered to be serious in Uganda are direct results of previous overbearing of the trees, which were not relieved in time by the stripping of the crop.

(7) Preparation of Coffee in Uganda.

With very few exceptions, the factories on coffee estates in Uganda are of a poor type, and arrangements for pulping, fermentation, washing and drying are very primitive. Far too many pulpers are being turned by hand, where with little trouble water power could be utilised. On the whole the proportion of labour employed in the factory is extremely excessive as compared with the total available on the estate.

Feeding to Pulper.—At present on many estates this is done by hand, when with a little expenditure automatic feeding could be fitted; especially is this the case in the Toro district.

On no estates have I seen any arrangement for preventing the passage of small stones into the pulper. It is an easy matter to arrange the pulper to be fed with coffee by the water stream used for pulping and to arrange a catch pit about 12—15 inches deep just in front of the pulper to trap any gravel which may be mixed with the coffee.

Pulping.—In many cases the copper cylinder covers have been used backwards, so that the cutting edges of the cylinder come into contact with the beans and results in many cut and pinched beans. By reversing the cylinder cover this can be avoided and, though pulping will be slow, it will be of a much better quality. Some planters do not appear to understand the proper setting of the pulpers, and in these cases I have been able to advise them.

Fermentation.—The quality of the fermentation in Uganda is satisfactory on the whole.

Washing.—The best system of washing the fermented coffee is in a tank situated below the outlets of the fermenting tank. The first rough washing should be done in the fermenting tank and the light beans floated off into the lower washing tank. These "lights" after further washing are then removed to the drying ground. Afterwards the heavy coffee is let out into the large washing tank and thoroughly washed before removal to the drying ground. This is the system used in the West Indies and appears to be superior in every way to that at present in use in Uganda.

Many estates have erected very long washing channels with the idea of grading the beans at the time of washing. After repeated inspections of these, I am of opinion that such a process is unnecessary and all that is required is the separation of the "lights" and refuse from the sound beans. This is much more conveniently carried out in a tank.

Drying.—The present method of drying on trays leaves much to be desired, on account of the labour required in dealing with trays in showery weather and also on account of the very uneven drying resulting from the use of this method.

A concrete drying ground would be far more satisfactory, and I have repeatedly explained its use to planters, but up to the present only very few seem to be interested enough to try this system.

The quality of the drying under present conditions in Uganda is very inferior, and almost every bag of coffee sent home for sale contains all possible grades of coffee as a result of this process. Good coffee is mixed with underdried and overdried, with the result that the prices obtained are lower than they should be.

Hulling.—It is essential that coffee be thoroughly dry before being hulled. After the completion of the drying process the coffee should be left in the huts for two days, and then tested for dryness. If satisfactory it should be warmed in the sun again and then hulled. It is important that too much pressure be avoided in hulling, and the coffee should not be warm when it comes from the machine. After hulling, the coffee can be repassed slowly through the machine, to get rid of most of the silver skin and to polish the beans.

Grading.—Very few estates have good machinery for grading the coffee, and improvement in the grading of Uganda coffee is very necessary to obtain a better market. After putting the hulled coffee through a mechanical grader it should be hand picked before leaving the factory.

Bagging.—No coffee should be placed in unused bags fresh from the bale. The bags contain certain oils in the fibre and the coffee absorbs the smell and taste of these oils from the bag. All bales of new bags should be opened and thoroughly sunned before use. After a thorough sunning they can be used for transferring coffee around the factory for a time to get rid of all traces of oily smell. They should not be kept stacked.

General.—Many of the troubles experienced by European planters in dealing with the cultivation of *arabica* coffee are due to inferior planting and to mistaken ideas of cultivation, but with improvement in these respects the diseases and pests so commonly reported at present should in a large measure disappear. Increased attention to the design and working of the factories will do much to improve the general run of Uganda coffee.

W. L. MUNN,
Coffee Officer.

ANNUAL REPORT OF THE SUPERINTENDENT, AGRICULTURAL EDUCATION.

During the year 1927 the absence of a class of agricultural students at Makerere College has made it possible for more time to be devoted to the organisation of agricultural education in the schools administered by the Missionary Societies; it has also enabled me to spend approximately half of my time in the general supervision of field experimental work in Buganda, which has been placed under my charge. This latter work has enabled me to keep in close touch with the practical side of the work, so necessary for anyone concerned with agricultural education. In the absence of an Economic Botanist until the last few days of the year, a certain amount of the routine work of that office has devolved upon me.

Normal Schools.

In addition to the three boys' schools that were in being during 1926, *viz.*, those of:—

The White Fathers' Mission, at Bikira in Masaka District,
The Mill Hill Mission, at Nazigo in Bugerere,
The Church Missionary Society, at Mukono in Kyagwe;

two others were started in the Eastern Province during 1927 by:—

The Church Missionary Society, at Nabumale near Mbale,
The Mill Hill Mission, at Ngora in the Teso District.

These schools were visited as follows:—

Bikira during June,
Nazigo in May and June,
Mukono in May, June and September,
Nabumale in July,
Ngora in August,

and the Church Missionary Society Girls' Normal School at Gayaza in September, October, November and December.

I was accompanied, on some of these visits, by the Coffee Officer, and demonstrations and instruction were given in the care and pruning of coffee trees and also of various kinds of fruit trees.

Elementary Agriculture and Nature Study is now well established in these schools. Each centre has its school garden; and the necessity has everywhere been stressed of making the garden the focus of the school agricultural work. Results have necessarily varied from place to place and the abnormally low rainfall during the year has hindered the work generally, but it may be considered as generally satisfactory. It is necessary, however, to bear in mind that the work done so far is only preliminary, and as the general standard of proficiency of these schools rises, a corresponding advance should be possible in the type of agricultural work attempted.

The "Nature Study Notes" were still in the course of preparation at the end of the year, as it was found that sufficient of these had been prepared to carry the classes on to the end of 1927, and also as it had been decided not to publish these in book form until they had been tested in the schools for at least a year. The Assistant Entomologist was good enough to prepare a set of eight lessons (with illustrations) describing local insect types, for use in these schools.

The agricultural work for the Government Normal School on the Makerere site was discussed with the new Principal on his arrival towards the end of the year.

Makerere College.

The Makerere agricultural student, who finished his course at the end of 1926, was taken on the staff of the Department at the beginning of the year, on probation for two years, as Laboratory and Field Assistant under my supervision. He has made very satisfactory progress.

Elementary Vernacular Schools.

Comparatively few schools following the Elementary Vernacular syllabus are yet in existence, but visits were paid to the following:—

Bombo Military School.—This school was visited in April, with a view to starting agriculture as a regular subject. Great keenness was shown by the authorities, and a school garden was planned and help given in the matter of supplies of plants and seeds. The school is visited by the Agricultural Officer stationed at the Government Agricultural Experimental Farm at Bukalasa.

White Fathers' Mission Elementary Vernacular School, Gayaza.—Two visits were paid to the school. A creditable school garden is in existence and a start has been made with Nature Study.

Girls' Schools.

In addition to the above-mentioned visits to the Normal School at Gayaza, a course in Elementary Nature Study was given at the Girls' High School at Gayaza during the Michaelmas term.

Cadets, Provincial Administration.

During June a number of practical demonstrations in the agriculture of the country were given to newly joined Administrative Cadets.

Courses for Native Instructors.

During the latter half of July and the first part of August I toured the coffee growing areas of Bugishu with the Coffee Officer. The native coffee instructors of that district accompanied us throughout the tour and were given daily practical instruction in the pruning and general care of Arabian coffee. A careful examination of these men at the end of the period showed that they had taken full advantage of the course.

The native agricultural instructors from the Masaka District were given a month's course in general agriculture at Kampala during September. Now that better accommodation for teaching is available it should be possible to keep in closer touch with native instructors from all districts, especially in those cases where they are not working directly under an Agricultural Officer, and to put them through a month's course every year, during the slack season.

School Farms.

About the middle of the year the Principal of the Intermediate School at Mbarara visited Kampala and discussed with me the possibility of establishing a small school farm, where the pupils could spend the hours allotted to "outdoor work," and where vocational training could be given to boys leaving school and who wished to learn to farm. Arrangements were made for one of the more promising of the farm pupils from the Kampala plantation to be engaged as farm headman and he proceeded to Mbarara at the beginning of October. At the same time, one of the boys leaving the school was sent to Kampala to be taught general agriculture, including the management of a small farm, so that he can return, later, to the school as an agricultural master.

A suitable lay-out and scheme of cropping was devised for the farm and advice given as to its utilisation for teaching purposes.

I paid a visit to Mbarara during the last week in October. The site selected for the farm appeared to be satisfactory and possessed adequate grazing and a water supply close by. (It was interesting to find, growing wild on the site, plants of *Alysicarpus Zeheri*, a leguminous fodder plant resembling "Lucerne," which had recently been investigated on the Kampala plantation, and which was favourably reported on by the Veterinary Department, who fed it to their stock). A kraal had been built and four oxen installed. These cattle had been partly trained to the yoke some time ago, but they needed further training before ploughing could commence. A plough, chains and yokes were supplied by the District Commissioner. Twelve acres were pegged out and part of this had been ploughed by the end of the year, and cultivation should be far enough advanced to enable the whole farm to be planted in the next spring rains.

This experiment has been described rather fully because it is the first example, as far as I am aware, of an attempt to teach vocational farming, on the part of school authorities in this country, and the results will be watched with interest.

A visit was paid to the King's School, Budo, during November to discuss the line of work for the agricultural vocational class that is being started there next year.

Government Plantations.

The plantations, both at Kampala and at Bukalasa, have been utilised to a considerable extent during the year for educational purposes; and the siting of the new laboratories on the former should render such teaching yet more effective in the future.

A three-acre model peasant holding has been established at Bukalasa; this is being worked on an approved rotation and detailed accounts are being kept. Similarly an eight-acre holding, workable by a pair of oxen, is being started on the Kampala Plantation. Both of these, as they develop, will be a very considerable help for teaching purposes.

Other Work.

Reports upon the Field Experimental work and upon the native Robusta coffee industry, in the Buganda Province, are being forwarded separately.

E. G. STAPLES,

Superintendent of Agricultural Education.

ANNUAL REPORT OF THE COTTON BOTANIST, 1927.

The writer was on home leave during the months of January, February, and March, during which time the cotton experimental work was carried on by Mr. Killick, assisted by Mr. Stephens.

The writer returned from leave in April and was at Serere during the remainder of the year with the exception of two short safaris in Teso in connection with the laying out and sowing of experimental plots.

Mr. Stephens proceeded on leave in February and returned to Serere in October.

Cotton Experimental Work.

Owing to the limitations of space it is impossible to give here the full details and results of the experiments conducted during the year; for these, reference may be made to the Empire Cotton Growing Corporation's Annual Report of Experiment Stations, 1927.

The 1926-27 season proved very unsuccessful for cotton and as a consequence the results obtained were largely disappointing. Serere itself was unfortunate in suffering from a severe hailstorm in September, 1926, the effect of which was chiefly responsible for the poor results.

A. PROGENY ROWS.

Fifty progeny rows, each of twenty plants, were sown in July, 1926, and these proved a complete failure, hardly a dozen sound bolls being picked from the whole plot. The chief causes for this failure may be summarised as below:—

1. Mechanical damage by hail causing loss of buds and young bolls by shedding, and breaking off of young fruiting branches.
2. Entrance of disease through hail wounds.
3. Excessive rainfall in October and November causing boll and bud shedding and enabling boll rots to become serious.
4. Very dry weather in December and January which caused further shedding and also premature opening of bolls.
5. Jassids, which were encouraged by the dry spell mentioned above.
6. Bollworms and stainers caused some damage but were not more prevalent than in average years.

All the progeny rows were uprooted in January as the plants were only bare sticks.

Fortunately there was sufficient seed left from most strains to repeat them in 1927-28.

F. 2 generations of three crosses were sown but the failure of these was even more complete than that of the progeny rows and no results whatsoever were obtained.

B. FIELD EXPERIMENTS AT SERERE.

1. *Sowing Date and Spacing Experiment*.—After the experience of the 1925-26 season it was decided to combine the sowing date and the spacing experiments as it was probable that while one spacing would prove superior for early sowing, another would probably be the best for later sowings.

Five spacings ranging from 4 ft. by 2 ft. with two plants per hole to 3 ft. by 1 ft. were sown at each of three sowing dates, June, July, and August. Each spacing was repeated five times in 1/20th acre plots at each sowing date making a total of 75 plots.

Observation rows of ten plants per plot were demarcated and from these growth, flowering and bolling records were taken.

The results of this trial are summarised in Table I below:—

TABLE I.

Spacing.	4ft. by 2ft. 2 plants per hole.			4ft. by 2ft. 1 plant per hole.			4ft. by 1ft. 1 plant per hole.			3ft. by 2ft. 1 plant per hole.			3ft. by 1ft. 1 plant per hole.		
	June 10th	July 12th	Aug. 12th	June	July	Aug.	June	July	Aug.	June	July	Aug.	June	July	Aug.
Mean Yield per Plot, in lbs. ...	14'46	15'25	10'96	15'29	14'15	10'60	16'85	16'65	11'31	17'67	14'19	13'57	19'93	15'92	12'88
Calculated Yield per Acre, in lbs.	289	305	219	306	282	212	337	333	227	357	283	272	398	320	296

Although the increase in yield of June over August sowing is large it is not statistically significant and the same is true of higher yields of the close spacings, but there is a sufficient increase to give some indications of the effect of closer spacing and early sowing, and if such an increase is maintained over a number of years definite recommendations with regard to sowing dates and spacings for Teso and similar districts will be able to be made.

2. *Variety Trial*.—Four Nyasaland strains, N.17, N.19, N.24 and N.6, were grown in a yield trial, five 1/20th acre plots of each strain being sown on the same plot as the spacing trial.

The final figures from these plots gave no indication of the superiority of any one strain.

3. *Ridging Experiment*.—This experiment was initiated to test the value, if any, of growing cotton on ridges as has been successfully practised in other cotton growing countries. Five plots were ridged at a spacing of 4 ft. by 2 ft., and five were sown on the flat in the normal way at the same spacing. The results from this year's plots were inconclusive.

4. *Small Bulk Increase Plots*.—Four strains—S.G. 15, S.G. 26, S.G. 27 and S.G. 29, which had been selected from the 1925-26 progeny rows, were grown in isolated plots of one-quarter acre in area or over. These plots were carefully rogued and 100 bolls, each from a separate plant, were picked from each plot and examined in the laboratory with the following results:—

TABLE II.

Strain.	Locus Number.	No. of seeds per boll.	Seed weight per boll.	Lint weight per boll.	Lint length (mm).	Lint Index.	Ginning outturn.
S.G. 15 ...	4'09	31'89	3'72	1'63	31'9	5'11	30'4
S.G. 29 ...	4'09	33'28	3'85	1'87	29'9	5'63	32'7
S.G. 26 ...	4'08	33'65	3'54	1'79	29'0	5'31	33'6
S.G. 27 ...	4'10	33'12	3'75	1'73	29'9	5'23	31'6

Of these, S.G. 29 gave the indications of being the highest yielder, as can be seen by inspecting the table.

It was satisfactory to observe that the strains had kept very true to type and showed very little variation.

Lint from each of these strains was sent to England for spinning tests, the results of which are given in Appendix No. 2.

Cotton Experiments at Other Centres.

Variety yield trials and spacing tests were conducted at Kampala, Bukalasa and Ngetta Plantations, but no conclusive results were obtained except with the spacing experiment at Ngetta, where close planting 3 ft. by 1 ft. gave a considerable increase over 4 ft. by 2 ft.

Preliminary spacing tests were conducted at the following centres in Teso and Lango:—

TESO :—Nyero, Tira, Labori, Katakwi.

LANGO :—Aduku, Dokolo, Kaberamaido.

In these cases there were ten 1/20th acre plots, five being sown at a 4 ft. by 2 ft. spacing and five at 3 ft. by 1 ft. Not one of these trials gave any indications of one spacing being superior to the other in either Teso or Lango.

Laboratory Work.

The sulphuric treatment of seed was further investigated and the results of the tests are referred to under the 1927-28 section below.

Numerous observations on germination, root development, lint length, breaking loads, etc., were made.

Samples of seed cotton were received from most cotton growing areas of the Protectorate, and each one was examined and a report given. Forty-seven samples were reported on and the summary of their quantitative characters is given in Table III below:—

TABLE III.

County of Origin.	Number of Samples.	Mean Lint Length. (mm).	Weight of 100 Seeds (in grms).	Lint Index.	Ginning Outturn.	Seed Purity %
Teso ...	9	28.42 ± 2.44	10.31	5.02	32.6	90.2
Lango ...	9	28.72 ± 2.36	10.23	5.19	33.6	88.1
Bugwere ...	8	28.17 ± 2.47	10.36	5.30	33.3	76.6
Budama ...	6	28.00 ± 2.33	10.59	5.35	33.9	71.0
Bugishu (N.) ...	2	28.32 ± 2.28	10.55	5.12	32.5	83.0
Bugishu (S.) ...	2	27.91 ± 2.84	10.05	5.29	34.4	59.0
Busoga (old) ...	3	29.13 ± 2.15	10.33	4.99	32.6	68.0
Busoga (new) (N.17) ...	3	29.8 ± 1.68	11.25	5.69	33.6	97.0
Bulemezi ...	2	30.66 ± 2.16	12.10	5.40	30.8	98.0
Hoima (old) ...	1	27.54 ± 2.98	9.64	4.53	32.0	83.0
Masindi (new) (N.17) ...	1	30.96 ± 2.16	10.91	5.13	31.9	96.0
Gulu ...	1	28.96 ± 3.16	10.69	5.33	33.2	76.0

An inspection of the above table shows clearly the very beneficial effect of the introduction of new seed into parts of Busoga and also Masindi.

These results indicate the necessity for a change of seed at Gulu, Hoima, South Bugishu and parts of Busoga.

The staple as a whole is under the 1.3/16ths standard and would probably be classed as full 1.1/8th.

1927-1928 Season.

No actual results are to hand at the time of writing but all the experiments which are being conducted at Serere are promising very well despite very adverse weather conditions, resulting in extreme dryness. The success of these plots gives a very excellent example of the effect of continual interculture in dry weather.

Progeny Rows.

The rows which had been grown in 1926-27 and failed, were repeated where seed was still available and were sown in June in rows of 35 plants at a spacing of 5 ft. by 2 ft. In addition to these, several other rows were sown from selected plants from the 1925-26 rows and also of several newly imported varieties from America, Northern Rhodesia and South Africa. Eleven selected strains from Bukalasa were also grown.

Altogether 50 rows were planted and up to the time of writing they have given promising results. The plants are selfed in the usual way and every boll examined in the laboratory, while flowering and boll records are kept regularly.

The following list gives the strains and varieties of cotton under observation at Serere:—Nyasaland Upland, Allen, Sunflower, Salisbury, Webber Long Stapled Upland, Meade, Kasch, Lone Star, Mebane, Arizona, Acala, Improved Bancroft and Sea Island.

The F. 2 generations of three crosses and the F. 1 of one were sown at the same time as the progeny rows and numerous observations are being made on them.

Small Bulk Increase Plot.

Owing to the failure of the previous year's progeny rows no seed was available for increase plots but a one-quarter acre plot was sown with S.G. 7, a strain of the Salisbury var, selected in 1925. The idea of growing this strain is to build up a small supply of seed for testing in districts such as Usuku County where the soil is poor and liable to drought. Up to the time of writing the strain has shown promise especially with regard to drought resistance and freedom from bad Jassid attacks.

Bulk Increase Plots.

Three strains, S.G. 15, S.G. 26 and S.G. 29, were grown in isolated increase plots at Serere as follows:—

<i>Strain.</i>	<i>Sowing date.</i>	<i>Approx area.</i> <i>Acres.</i>		<i>Spacing.</i>
S.G. 15	... July	...	2	5 ft. by 2 ft.
S.G. 26	... August	...	1½	5 ft. by 2 ft. and 3 ft. by 1 ft.
S.G. 29	... July	...	7	5 ft. by 2 ft.

All have given surprisingly high yields despite a somewhat poor stand in the case of S.G. 29 owing to very dry conditions immediately after sowing. Lint samples have been sent home for spinning tests.

Variety Trial.

The three strains mentioned in the above section together with S.G. 27, N.17, and N.19 were sown in a yield trial in July conducted on similar lines to the previous year, making a total of 30 1/20th acre plots. In addition to the yields, observation rows were demarcated in the plots and complete growth, flowering and bolling records are being made.

Similar trials are being conducted at Ngetta and at Bukalasa.

Sowing Date and Spacing Experiment.

This is being continued on an extended scale—seven spacings being sown at each of the three sowing dates making a total of 105 1/20th acre plots.

Other Field Experiments.

The following trials are being conducted at other centres:—

Bukalasa	...	Variety trial and spacing experiment.
Kampala	...	Variety trial.
Ngetta	...	Variety trial and spacing test.
Simsa	...	Combined spacing and variety trial.
Labori	...	" " "
Achuna Estate	...	" " "
(By the courtesy of Messrs The Bombay Uganda Co.).		
Torona	...	Three strains under observation.
Katakwi	...	Spacing test.
Nyero	...	"
Katini	...	"
Kyere	...	"
Tira	...	"
Aduku	...	"
Dokolo	...	"
Kaberaido	...	"

It is unfortunate that it has not been possible to visit these experiments as often as necessary.

Sulphuric Acid Treatment of Seed.

Laboratory germination tests confirmed the results of last year, showing a significant increase in germination by treating the seed with concentrated acid.

Owing to the possibility of an after effect of acid treatment, the test was conducted on a small field scale with N.17 cotton. Four rows were sown of each of the following treatments:—

Control	...	No treatment.
Water soaked	...	Seed soaked in water for 20 minutes immediately previous to sowing.
H ₂ SO ₄ (A)	...	Seed treated with acid for 20 minutes some weeks previous to sowing, washed in water and dried, sown dry.
H ₂ SO ₄ (B)	...	Seed treated with acid for 20 minutes immediately previous to sowing, washed in water and sown wet.
H ₂ SO ₄ (C)	...	Similar to H ₂ SO ₄ (B) but seed taken from surface of liquid.

The germination of H₂SO₄ (B) was very rapid and high, giving statistically significant increase over control.

Complete growth, flowering and bolling records are being made and the results will show whether acid has any after effect, deleterious or otherwise, on the cotton plant.

Pupils.

The average number of pupils in residence is 35. Quite a good lot of Teso boys have passed through during the year and their conduct has been excellent. When time permitted they were given lectures on elementary agriculture and botany twice a week and periodical tests were held. The pupils are responsible for flower tying, flower counts and the maintenance and picking of all experimental plots, which gives them the opportunity of learning the value of accuracy and care.

Buildings.

The extension to the laboratory was completed on 15th December and as a result much of the congestion was removed.

Personal.

The writer is glad of this opportunity to express his gratitude for the efficient way in which the work was carried on by Mr. Killick during his absence on leave, and also to record his appreciation of the excellent work which Mr. Stephens is doing.

A further word of thanks is due to the Teso Administration for the assistance they have given in the conducting of outside experiments.

G. W. NYE,

Cotton Botanist.

ANNUAL REPORT OF THE GOVERNMENT ENTOMOLOGIST.

The Entomologist was on duty in the Protectorate for the whole year excepting one month's absence for local leave. The Assistant Entomologist departed for home leave on July 4th and was still absent at the end of the year; details of his work are embodied in this report. Mr. Hancock, accompanied by the Mycologist, made one tour in the Eastern Province for observations on cotton insects. The Entomologist toured the Masindi and the Island coffee areas (the latter in company with the Mycologist) and inspected twenty-three non-native estates and a great number of native plots. A special joint report on the tour of the Sese Isles and Kome was submitted.

In collaboration with the Mycologist the whole of the legislation dealing with importation of plants and with plant pests in the Protectorate was revised during June; the new draft Ordinances have not yet been published.

During the absence of a Botanist, Mr. Hancock arranged, for easy reference, a list of Uganda plants and their local names, compiled mainly by Mr. T. D. Maitland and Mr. J. D. Snowden. Such a list is necessary to obtain names of food plants of insects.

A number of pupae of *Spalgis lemolea*, Druce (*Lyacaenidae*), the larvae of which prey on mealy-bug, were sent to the Entomologist for Kenya and the adults were liberated in a coffee area infested by mealy-bug.

Removal to the new building took place in November. No serious breakages of insect specimens or apparatus occurred.

Instruction.

Seven separate groups of agricultural instructors were given information on the life-histories and control of cotton and coffee pests. Mr. Hancock prepared in the vernacular an elementary course of entomology for use in primary schools. The Entomologist gave a talk to senior scholars at the Masindi school on the subject of coffee and sweet potato pests; the Rev. H. Bowers kindly acted as interpreter.

Specimens Received.

Thanks are due to the following for insects received for the collection:—Dr. G. D. H. Carpenter, for 1,200 specimens of various orders; the Hon. L. M. Seth-Smith for *Dermestidae*, mosquitoes, and caterpillars; Mr. D. N. Stafford, for beetles and caterpillars; Mr. F. W. Hall for caterpillars and *Coccidae*; and the Medical Entomologist, Kenya, for named mosquitoes.

Insects for identification were received from the Conservator of Forests, the Chief Veterinary Officer, and the Sanitary Inspector, Kampala.

The Reference Collection.

Many additions have been made to both the spirit and the pinned collections. Upwards of two thousand insect specimens new to, or not named in, this collection were submitted for identification to the Imperial Bureau of Entomology. Numerous named specimens have been incorporated with the collection. The native assistant, Musa Magala, has made many coloured drawings of immature stages which will be of assistance in the identification of such insects; Mr. F. W. Hall has kindly made coloured drawings of coffee and cotton insects.

We are indebted as usual to the Imperial Bureau of Entomology and also to the following specialists for the identification of insects:—K. G. Blair, W. E. China, C. H. Curran, F. W. Edwards, Lt. Col. F. C. Fraser, Dr. J. J. E. Gillet, F. Laing, G. Bénard, V. Laboissière, P. Esben-Peterson, P. Blüthgen, R. Kleine, F. Spaeth and A. Zimmermann.

Literature Received.

The entomological publications of the following Departments of Agriculture:—Kenya, Nyasaland, Sudan, Egypt, South Africa, Belgian Congo, Malaya, Jamaica, Trinidad, United States, Hawaii, Brazil and Java. Our thanks are also due for the New Zealand Journal of Agriculture, the International Bulletins of Plant Protection, the Indian Forestry Entomological Bulletins, University of California Bulletins, U.S. National Museum and Smithsonian Institute Bulletins, Reports on Insects collected by the Swedish Expedition to Elgon, and Bulletins of the Indian Tea Association.

Plant Imports.

Two hundred and forty-nine packages of plants and seeds were inspected during the year. As usual the Kenya Plant Inspector at Mombasa kindly passed the plants in transit and sent the Entomological monthly lists of such imports. It would, however, be much more satisfactory if arrangements were made for thorough inspection at Mombasa of all plants consigned to Uganda, and prohibited importations seized; this system would prevent any possibility of introduction of pests in such packages of plants as do not reach the Entomologist and, indirectly, it would protect the crops in Kenya.

Below is given a summary of the year's work on insect pests and records of their occurrence in Uganda:—

1. Coffee.

(a) *Antestia*—VARIEGATED COFFEE BUG.

As usual the bugs *Antestia lineaticollis*,* St. and *A. faceta*, Germ. have caused considerable damage to Arabica coffee, the former species in the Masaka area, and the latter in the Masindi area. Near Masindi, the bug was notably more prevalent on trees in murram soil at the time of my visit, which was at the end of a period of drought. On one estate in that area *A. faceta* was moderately prevalent on a small plot only—the same plot as the one attacked by the bug when I inspected the estate in 1924. It is hoped that the Agricultural Chemist will shortly be able to investigate the soil conditions because these seem to have an important bearing on the occurrence of this bug and of other types of sucking insect.

(b) *Stephanoderes hampei*, Ferr.—BERRY-BORER.

Several outbreaks of the berry-borer have been reported. In one instance the berries on a part only of an estate were severely attacked; practically all the berries had been bored while unripe and the beans had decayed before they were collected for examination.

No new factors having a bearing on control of this pest have been discovered.

(c) *Pseudococcus lilacinus*, Ckll.—ROOT MEALY-BUG.

In various areas a small number of trees have been observed to be attacked by this species.

On one estate several trees showed a marked yellowing of the foliage and examination of the roots revealed the presence of mealy-bug on some trees only; all the trees, however, were found by the Mycologist to be suffering from *Rhizoctonia bataticola*, and this disease (or some other cause of ill-health of the trees) must be regarded as the predisposition to attack by mealy-bug. Similar evidence was obtained during inspection of native-grown coffee on the Sese Islands.

In other instances, the coffee trees had never shown satisfactory growth, and all such trees proved to be attacked by the root fungus *R. bataticola*, root mealy-bug being present on but a small proportion of them.

Calcium cyanide was tested as a control for *P. lilacinus* and it proved successful. The result was an immediate improvement in the general appearance of the treated trees; probably much of this effect was due to improvement of the soil by the lime of the insecticide.

*The coffee bug previously known as *A. lineaticollis*, St. has been proved to be of two species which are now known as *A. lineaticollis*, St. and *A. faceta*, Germ.

(d) OTHER *Coccidae*.

The following scales have been prevalent on small areas where conditions rendered coffee plants susceptible to attack:—*Icerya nigroareolata*, Newst.; *Ceroplastes ceriferus*, And.; *C. vinsonioides*, Newst.; *Lecanium subacutum*, Newst. (parasitised by undetermined Hymenoptera); *L. viridis*, Green (parasitised by the fungus *Cephalosporium lecanii*); *Saissetia hemisphaerica*, Targ. (parasitised by fungus *C. lecanii*); *Asterolecanium hancocki*, Laing; *Selenaspidus articulatus*, Morg.; and the mealy-bug *Pseudococcus virgatus*, Ckll.

The evidence obtained over a long period has formed the basis of my opinion that the prevalence of *Coccidae* and other sucking insects is a sign of weak health in the attacked plants. This weakness may be due to various factors: bad planting (broken or twisted tap root), fungal root disease, shallow or otherwise unsuitable soil, neglected cultivation, or unsuitable methods of cultivation.

(e) *Diarthrothrips coffeae*, Will.—THRIPS.

During the drought early in the year several outbreaks of this pest were reported. On one estate the attack resulted in the loss of the whole crop. Light or stony soils greatly favour this pest; such soils should be well protected from the sun and rain-wash by mulching, cover crops or shade trees; it is essential that the soil humus be preserved and replenished so that water may be retained in the soil.

(f) ABORTION OF COFFEE FLOWER-BUDS.

This phenomenon, recorded for the first time during 1926, continued during the early months of this year in areas other than those previously concerned. Of the five species of *Capsidae* observed attacking coffee flower buds only one, *Volumnus obscurus*, Popp. has yet been identified. An attempt was made to test damage by such Capsids but no positive result was obtained; the bugs died within a few days and aborted flowers occurred equally on exposed and protected branches.

A short paper to open a discussion of the subject was read at the Planters' Conference and such opinions as were put forward were in favour of weather conditions being the cause.

(g) STEM BORERS.

Apate indistincta, Murr. (*Bostrychidae*) was reported in native grown Arabica coffee in Bugishu.

Dirphya princeps, Jord. (*Lamiidae*) was recorded during 1927 from several areas in both Robusta and Arabica coffee. Neglected cultivation, resulting in bushy growth and tall weeds, appears to favour this pest—perhaps these factors hinder the good work of the Braconid parasite of the larva.

(h) LEAF-EATING INSECTS.

Metadrepana glauca, Hamps. (*Drepanidae*) has attacked both species of coffee in various districts. It was recorded for the first time from Bunyoro.

Other leaf-eaters, all of minor importance, were:—*Parasa* sp. and *Thosea aurifrons*, B.-Baker (*Limacodidae*); *Lygropia amyntusalis*, Walk. (*Pyralidae*); *Cephonodes hylas*, Linn. (*Sphingidae*); ? *Trochalus* sp. (*Melolonthidae*); and *Epiplema dohertyi*, Warren (*Epiplemidae*). The last named is a leaf-skeletoniser which was controlled by parasites including a Chalcid, a Braconid and an Ichneumonid; hyperparasites reared were two Chalcidoids and two Ichneumonids.

(i) OTHER COFFEE INSECTS.

Gonocephalum simplex, Fab. (*Tenebrionidae*) attacked bark near the collars of the main stems. The insect was evidently encouraged by the presence of tall weeds covering much decaying vegetation on the soil surface.

Isaniris pusillus, Hust. (*Curculionidae*) is still but a minor pest in the Masindi area.

Termites—these are discussed under section 7 below.

2. Cotton.

Before his departure on leave the Assistant Entomologist had charge of investigations of cotton insects. He returned in January from a tour of the Eastern Province where, in collaboration with the Mycologist, he had been making observations on cotton pests. A special report on the tour was submitted.

Further work was done on the relationship between insects and internal boll-rot with particular reference to *Dysdercus* spp. (stainers).

The investigation of the effect of different foods on the life-cycle of *Dysdercus* spp. was commenced, the aim being to obtain indications of the causes of rapid increase and of the ability of the pest to tide over the close season. This work was discontinued owing to dearth of cotton bolls. Details of the results are withheld until a complete series of observations has been carried out.

The following pests and parasites of insects on cotton have been observed :—

Capsid bug (? species) with glaucous green nymphs feeding on young bolls.

Pseudococcus brevipes, Ckll. on roots of cotton.

Dysdercus spp.—These appeared in appreciable numbers during the present cotton season only after the heavy rain in December, the drought apparently having made the insects aestivate or remain on wild food plants.

Aphis gossypii, Glover (also on *Hibiscus esculentus*)—*Zenillia corrupta*, Curran (*Tachinidae*) was reared as a parasite of the Aphid predator *Syrphus adligatus*, Wied.

Syagrus calcaratus, Fab.—Root grub.

Tenebrionid larvae on sown cotton seed (similar larvae have been observed attacking rotting cotton seed above ground).

Wireworms attacking sown seed, and cotton stems at the collar.

Euxoa longidentifera, Hamps.—Cutworm.

Elarias sp., parasitised by *Microbracon* sp. (*Braconidae*) and *Actia nana*, Curran (*Tachinidae*).

Caterpillars in stored seed.

Termites (see section 7).

3. Native Food Crops.

(a) PLANTAIN AND BANANA (*Musa* spp.).—A widespread outbreak of the root weevil *Cosmopolites sordidus*, Germ. occurred. Despite instructions for combating the pest the native did little or nothing to reduce the numbers of the insect. It was stated by natives that the appearance of this was a sign of famine and it may well be so when the growers do nothing to control the pest.

(b) SWEET POTATO (*Ipomea*).—A serious outbreak of the leaf-eating caterpillar (*Acraea acerata*, Hew.) occurred early during the year in the Masindi area and supplemented the effect of the drought by delaying for two months the maturing of the potato crop. The following parasites have been reared from *A. acerata* :—*Charops* sp. *Ichneumonidae*; and *Zenillia normula*, Curran (*Tachinidae*).

(c) GROUND NUT (*Arachis*).—The Aphid recorded as the vector in Uganda of “rosette” disease has now been identified as *Aphis laburni*, Kalt.

A Jassid—probably *Empoasca* sp.—was noticed in considerable numbers on the leaves.

A few plants in a condition of wilt were attacked by *Pseudococcus* sp. on the developing seed pods. The Mycologist proved such plants to be suffering from a *Fusarium* disease.

Termites (see section 7).

(d) MAIZE (*Zea*).—The stem-borer *Busseola fusca*, Hamps. was responsible for considerable damage.

A new minor pest to be recorded is a Pyralid stem-borer of uncertain genus.

4. Sugar Cane.

The damage by the borer *Sesamia vuteria*, Stoll. has been negligible on the only large plantation in Uganda. The control measures advocated, assisted by the Tachinid parasite, appear to have been successful.

Pseudococcus sacchari, Ckll. was noticed in small numbers and only on weakly growing canes.

Termites—see section 7.

5. Para Rubber.

Investigation of attacks by Scolytid stem-borers proved that only trees weakened by *Rhizoctonia* root disease, by other diseases, or by mechanical injury, were subject to such attacks.

6. Miscellaneous Plants.

(a) ORNAMENTAL PLANTS.

Megalognatha rufiventris, Baly, (*Galerucidae*) attacked rose, mango, and flamboyant flowers—this beetle appears to be a general flower feeder.

Sphingid caterpillar and *Glyphodes sericea*, Dru. (*Pyralidae*) attacking young leaves.

Phlox, *Monolepta ?kirschi*, Jac. (*Galerucidae*) denuded plants of leaves and flowers.

Icerya nigroareolata, Newst. on rose.

On lilies, *Brithys pancratii*, Cyr. (*Noctuidae*) this caterpillar usually confines itself to species with fleshy leaves, particularly native species.

(b) ECONOMIC PLANTS.

On Citrus, the caterpillar of *Papilio demodocus*, Esp. (parasitised by the Tachinid *Zenillia evolens*, Wied.), and *Lepidosaphes beekii*, Newm., of which a severe infestation occurred on a young plant which proved to have the root disease *Rhizoctonia bataticola*.

On *Morus* sp., *Inesida leprosa*, Fab. (Lamiid stem-borer) numbers of old plants were killed.

On loquat, *Pogononeura xantholepia*, Hamps. (*Pyralidae*) caterpillar boring in ripe fruit.

On papaw (*Carica*), aphid infesting young leaves preyed on by the larvae and adults of the Coccinellid *Halyzia variegata*, Fab.

On *Cinchona* sp., leaves of shaded trees attacked by a Capsid bug; trees growing in the open showed negligible damage.

On *Eucalyptus pilularis* and *E. punctata*, the cutworm *Euxoa longidentifera*, Hamps.; and the Lymantriid caterpillar *Notolophus vetusta*, Hamps.

In bamboo, the Bostrychid borer *Xylopertha picea*, Oliv.

On *Elaeis guineensis* (oil palm), *Rhynchophorus phoenecis* Fab. in the stem; *Aspidiotus cyanophylli*, Sign. on the seed; and an Aleurod on the leaves, the nymphs being parasitised by the fungus *Cephalosporium lecanii*.

On tobacco, the cricket *Brachytrypes membranaceus*, Drury, and Millepedes which were encouraged by too frequent watering of nursery beds.

On turnip (*Brassica*), *Pseudococcus citri*, Risso.

On potato (*Solanum tuberosum*), an unidentified caterpillar (? *Pyralidae*) boring in developing tubers.

On Sim-sim (*Sesamum*), a Cecidomyiid, producing galls and causing shedding of seed pods; later pods suffered but little damage because the pest was controlled by the parasites; seed pods were also attacked by the weevil *Cylas compressus*, Hartm.; damage to the tops of plants was caused by the Pyralid caterpillar *Antigastria catalaunalis*, Dup.

On "kansambwe" fibre plant (*Hibiscus* sp.) the leaf-eating caterpillar *Acraea tersichore*, Linn.

On *Hydnocarpus* sp. (leprosy oil), the leaf-eater *Acraea zetes*, Linn.

7. Termites.

Information was sought on the treatment for termites in buildings, plantations and gardens.

In most, if not all cases of termite attack on living plants some fungal or other disease was present, and this rendered the plants suitable as food for termites. As examples of this, the following instances may be cited:—coffee seedlings with the root disease *Rhizoctonia*; groundnut plants (parts of) suffering from the fungal disease *Sclerotium rolfsii*, the healthy parts were not attacked; several acres of sugar cane attacked by termites proved to be diseased, ? *Fusarium* sp. being the cause; *Grevillea robusta* with *Rhizoctonia* root disease.

8. Mosquitoes.

The Assistant Entomologist, when not engaged on other work, continued his survey of mosquito breeding places in the Kampala area. Many slides of larvae were made to facilitate identification of species without rearing adults. Most of the mosquitoes reared during the survey have been named and a basis for further surveys has thus been laid down. The results will be published when a reasonably complete account can be given.

An interim report on the main breeding places of *Anopheles* in Kampala was submitted to the Medical Officer of Health in order that a start might be made on the control of malarial vectors. Since Mr. Hancock's departure other work has prevented continuation of the above-mentioned survey. During the various tours mentioned in the introduction above, special attention was paid to collection of mosquitoes and to investigation of their breeding places.

H. HARGREAVES,

Entomologist.

ANNUAL REPORT

OF

THE GOVERNMENT MYCOLOGIST

FOR PERIOD OCTOBER 11TH, 1926, TO DECEMBER 31ST, 1927.

I arrived in Uganda on October 11th, 1926, and took over the mycological work on the following day. During the period under review I have been absent from Kampala on tour for approximately ten weeks, including a visit to the Eastern Province in December—January, an inspection of the European plantations in the Hoima and Masindi Districts, and an inspection of the native *Robusta* coffee industry in the islands of Lake Victoria. In addition, several visits have been paid to Lugazi Sugar Estate and to European plantations in Kyagwe and around Kampala.

2. Coffee.

The root disease caused by *Rhizoctonia bataticola* is now known from all coffee growing areas in Uganda, but as a general rule the disease is limited to a few trees scattered through the plantations. Apparently the diseased trees do not act as sources of infection to neighbouring trees, as up to the present no evidence of the spread of the disease from tree to tree through the soil has been obtained. The host range of the fungus is wide, both on woody and herbaceous plants, and its wide distribution in Uganda indicates that the fungus is a common inhabitant of the soil.

In the islands of Lake Victoria this disease is more serious in extent than elsewhere in Uganda, and may possibly be correlated with a difference in soil and climate. The soils of these islands are lighter and more sandy than those of the mainland and the rainfall much heavier. The system of clean cultivation of the coffee plots on these light soils, together with the general bad planting out of the coffee seedlings, appears to render the trees more susceptible to this disease.

The normal progress of *Rhizoctonia* root disease on coffee is comparatively slow. The fungus first invades the minute feeding rootlets near the surface of the soil, and killing these, gradually works back along the roots towards the collar of the tree. The tissues of the inner bark are the first to be attacked and only at a comparatively late stage of the disease are the sclerotia of the fungus found in the tissues of the wood. The trees attacked show a general unhealthy appearance, with considerable dying back of the laterals and gradually dropping of the foliage. In the Sese Islands, however, some trees attacked by this disease die very suddenly, with the leaves and crop still hanging on the branches. In most of these instances, but by no means in every case, the original *Rhizoctonia* has been followed by other fungi, among which the characteristic rhizomorphs of *Armillaria mellea* and the mycelium of *Fomes lamaoensis* have been noted. The latter fungus, described in the East as the cause of "Brown Root Disease" of various trees, was definitely a secondary parasite in the case of diseased coffee in the Sese Islands. In one native plot of *C. robusta*, every stage in the disease was found, commencing with the original attack of *Rhizoctonia* on the small rootlets, afterwards passing along to some of the main roots nearest the surface of the soil, and finally marked by the rapid development of the brown mycelium of the *Fomes* with its adhering soil and gravel over the whole of the larger roots of the trees.

In other cases the rhizomorphs of *Armillaria* were noted as starting on the smaller roots attacked by *Rhizoctonia* and finally progressing beyond the limits of invasion of this fungus, to the main roots of the tree.

In no case was *Fomes lamaoensis* or *Armillaria mellea* found on coffee roots in the absence of *Rhizoctonia*, whereas in over 75 per cent of all cases of root disease, *Rhizoctonia bataticola* was alone present on the attacked roots. This evidence is all in favour of the contentions of my predecessor, Dr. Small, that *Rhizoctonia* is the primary invader in most, if not all, cases of "Brown Root Disease" and similar diseases formerly ascribed to fungi of the *Fomes* group.

"Dieback" of *Robusta* Coffee in Sese.—A detailed investigation into this "disease" has indicated that the symptoms are due to one or more of the following causes, and the results are given here for the information of coffee planters in other districts whose trees show this appearance:—

(a) *The Presence of Objectional Types in the Robusta Seed used for Planting.*—All seed at present available in Uganda is of very mixed origin, and gives a considerable number of different types of tree. One of these is characterised by its method of growth, in sending up three to five main shoots from the base of the tree instead of a single main stem and subsidiary suckers arising at a later period in the life of the tree. The leaves of this type of *robusta* are of a light green colour, and the internodes of the lateral branches long and thin. This type of tree as it grows sheds all the lower lateral branches, and never yields a reasonable crop.

The dying back of the thin laterals in this type of tree is inherent in the plant, and cannot be avoided. Such trees should be eradicated completely as soon as recognised.

(b) *Inferior Planting of the Seedlings from the Nursery*.—This is exceptionally poor in the case of the native cultivators in Sese, and most of the trees when pulled up show coiling, bending or distortion of the tap roots and other main roots. Such trees are unable to grow in a normal manner, and present a spindly appearance owing to the dying off of the lateral branches. It is impossible to be too careful in planting out coffee seedlings to ensure that the roots are sent out in a normal manner.

(c) *Inferior Cultivation*.—The light soils of the coffee plots in these islands have in the past been kept free of all weeds, with the result that the soil has been exposed to the sun and to the rain wash consequent upon the heavy rainfall of the islands. A common appearance is for the trees bearing a fairly heavy crop of berries to commence dropping the leaves from the laterals bearing the crop, and then these branches gradually die back to the main stem of the tree before the crop is ripe. This type of “dieback” can only be remedied by improvement of cultivation. Either weeds should be allowed to grow to cover the soil for most of the year, or green manure crops should be planted, or a heavy mulch of bush and leaves from the neighbouring forests applied to the soil. At the same time the various grass weeds must be kept down as these are fatal to coffee plantations. The best of these methods can only be determined by experiment over a period of years and a start has been made in some districts, with the advice of the Coffee Officer.

(d) *Planting on Unsuitable Soils*.—Some of the trees showing the worst cases of “dieback” in these islands were found to have been planted in very shallow soil, overlying practically solid rock. In these cases the cause of the condition was obvious.

(e) *Root Diseases*.—These have been dealt with above under *Rhizoctonia bataticola*. This fungus causes a gradual reduction in the aerial parts of the trees attacked, giving rise to symptoms of “dieback.”

Mealy Bug Root Disease.—This disease was described by Dr. Small in Circular No. 9 of this Department as being due to a combined attack of *Pseudococcus citri* and *Polyporus coffeae* on the roots of the tree.

During the period under review a number of cases of this disease have been examined in detail, and in every case *Rhizoctonia bataticola* was found present. This indicated that the latter was probably the original invader of the roots and that the combined attack of the mealy bug and *Polyporus* a secondary development. This hypothesis has lately been considerably strengthened by the discovery that the mealy bug is occasionally a pest on the roots of trees already attacked by *Rhizoctonia*. A complete series illustrating this was found in the Sese Islands, but no sign of the *Polyporus* was to be found. Inoculation experiments are now being laid down with a view to definite proof of this hypothesis.

“*Damping off*” of *Coffee Seedlings*.—A serious disease of young coffee seedlings was found during the year on the Government Plantation, Kampala. The symptoms were those of a “damping off” disease, the seedlings being attacked in the hypocotyl at ground level. The disease starts in isolated patches in the beds and rapidly extends in every direction. Where the beds are sown thickly the disease is worst, and it may be partially avoided by wide sowing. After the seedlings have formed four or more leaves the disease is not as rule troublesome.

During the period under review the planters of *C. arabica* in several districts have complained of the non-setting of coffee flowers, a phenomenon now known in Uganda as “dud flowering.” From some of the flowers a species of *Fusarium* was isolated from the dead and dying stamens, but inoculation experiments with this fungus by spraying on other coffee flowers failed to produce any effect. The typical “dud flowers” before opening of the petals show a discolouration of the base of the corolla, and in many cases the stamens are found to be shrivelled up and dark brown in colour. All evidence at present available seems to indicate that this is correlated with the unfavourable weather conditions of cold wet periods, but the correlation is not absolute.

The failure of some consignments of coffee seeds to germinate in the nurseries on the Government Plantation, Kampala, was probably due to their being planted under too wet conditions in the beds, and possibly over-drying of the seed before being planted was also a factor. Many of the seeds rotted, and chief among the fungi found present on them were a species of *Verticillium* and a *Fusarium* of the group *Elegans* (probably identical with that formerly described here as *F. udum* Butl.).

The eelworm *Heterodera radicola* has been found on the roots of some dead trees of *C. robusta* in association with *Rhizoctonia bataticola* and *Armillaria mellea*.

3. Hevea.

Brown Bast.—This is the most serious rubber disease present in Uganda, and seems to be on the increase. The Keuchenius method of treatment has been tried on the Government Plantation, Kampala, and the renewed bark is apparently free from the disease, though it is still present on some trees at ground level and below. As far as I am aware, no tapping has been carried out in Uganda on the renewed bark of treated trees, so that it is impossible to say at present whether on recommencing to tap such bark the disease will reappear.

Rhizoctonia bataticola has been discovered on rubber roots at the Kampala Plantation, in one case accompanied by *Armillaria mellea*. The trees attacked show a general poor appearance, with some dieback in the crown. In the absence of disease such an appearance would suggest poor soil conditions. On rubber in all cases found to date the *Rhizoctonia* was present on only those roots in the upper 10-12 inches of soil. It enters through the very fine rootlets as in the case of coffee, and these die back. Other young rootlets arise at the base of those attacked and serve to replace the latter until themselves attacked. The appearance of the root system of a rubber tree attacked by disease is characteristic, showing at the ends of the smaller branches of the root system bunches of fine roots, arising like the fingers of a hand, and all attacked by the disease. At a later stage the fungus travels back along the roots towards the base of the tree, but usually other fungi aid in this process. In the case mentioned above *Armillaria* appeared to have entered in this manner and to have travelled rapidly back along the roots to the collar of the tree, while the *Rhizoctonia* was still confined to small roots. It is hoped to carry out more detailed investigation of the attacks of this fungus on rubber during the coming year.

An unidentified disease of *Hevea* has been discovered on one estate. Some trees of four years old and upwards are scaling off their bark around the collar. This is quite a normal feature in Uganda, but in the present instance the scaling gradually gets deeper and deeper into the bark until upon removal of the dead scale the surface left consists of very young bark, yellowish-white in colour, and with black streaks and dots scattered over it. Up to this stage there is no evidence of fungus infection, but later the tissues become invaded by fungi and a rot sets up, which passes up the inner bark, and completely disorganises the tissues of this, leaving a dead outer shell of bark as a loose casing for the tree.

Oidium heveae is present all over Uganda, and causes some damage in wet weather on the young foliage. Its economic importance is still doubtful, so that control measures are not called for.

4. Cotton.

During the dry weather in the early part of the planting season a considerable loss of seedlings occurred on the Government Plantation, Kampala, from the "Sore shin" disease caused by *Rhizoctonia solani*. There is no doubt that the incidence of this disease is much greater in hot dry weather, and on the advent of more seasonable conditions the disease becomes of minor importance. In the present instance the disease necessitated replanting the whole plots attacked, but in more normal weather many of the seedlings attacked by the disease recover and grow normally. In hot dry weather they die off completely when attacked.

A few cases of attack by *Rhizoctonia* on adult plants have been found in experimental plots during the year, but on the whole Uganda cotton is resistant to the attack of this fungus, after passing the seedling stage.

A number of wilted plants were found on the Government Plantation, Kampala, some of which showed the presence of *Fusarium* hyphae in the wood vessels of the roots and base of the stem. Others showed no sign of the fungus, and the wilted plants, after dropping most of their foliage, subsequently recovered. Under these circumstances it is doubtful whether the *Fusarium* can be considered responsible for the disease, which appears to be of purely physiological origin.

In most districts occasional infections of angular leaf spot, caused by *B. malvacearum* are found, and a considerable infection of this disease was present on the Serere Plantation in 1926-27 season. In almost every case, however, infection of the plant by this bacterium is in Uganda limited to the leaves and the "Black Arm" form of the disease attacking the lateral branches is very uncommon. The latter is the only serious form of the disease, which cannot be considered of any economic importance in Uganda at present. Occasional infections have been seen on cotton bolls, and both field and laboratory observations have proved that the disease is carried inside the seed. Under present conditions the minor importance of the disease here does not warrant the expense and trouble of delinting the seed for planting, which has been recommended for the control of the disease in the United States of America. Under Uganda conditions such a method of control can only obviate the transmission of the disease on the outside of the seed, and the internal infections in the cotyledons are not destroyed and would serve to carry over the disease.

A sample of seed sent from Serere to the Government Plantation, Kampala, for experimental purposes showed from 10 to 12% of infection by *B. malvacearum* in the cotyledons as they emerged from the soil. During the dry weather following, the cotyledons were shed in the normal manner and with few exceptions the remaining parts of the plants were free from the disease and have remained so. It is noteworthy that the few exceptions to this were all infested with Aphides, especially along the lower surface of the main veins of the leaves. All infections were limited to these areas, and there is more than a possibility that the aphid was concerned in the transmission of the disease from the cotyledons to the leaves affected. At a later period the disease disappeared with the shedding of the infected leaves, and the plots in question are now entirely free from infection.

Internal Boll Rot.—This is the most important of the cotton diseases present in Uganda, and is responsible for considerable loss of crop and production of inferior qualities of lint. Considerable work has been carried out in the laboratory during the past year on this disease,

From infected bolls a number of organisms have been isolated, including *Nematospora gossypii*, *Aspergillus sydowii*, *Rhizopus nigricans*, *Mucor* sp., *Fusarium moniliforme*, various other *Fusaria*, *Alternaria longipedicellata*, *Monilia carbonaria*, *Cladosporium herbarum*, *Aspergillus tamari*, *Bacterium malvacearum*, and a number of other bacteria at present unidentified.

Laboratory work on the disease has been carried out with a view to the determination of the conditions under which each of these organisms is able to penetrate the wall tissues of the boll and to set up a rot of the lint inside. This part of the work is now almost complete, and the results indicate that with the exception of *B. malvacearum* all these organisms must be introduced into the lint cavities of the young bolls before any rotting of the lint can occur. None of the organisms was able to infect the bolls when merely sprayed on the outside surface of the uninjured walls, and only *B. malvacearum* proved capable of infection when only slight wounds were made in the outer tissues of the wall. It is possible that under moist weather conditions this bacterium can infect uninjured bolls in Uganda, but in repeated trials in warm dry weather it proved incapable of doing so. It is hoped to obtain further evidence on this point during the present season.

Several of the organisms enumerated above have proved non-pathogenic to cotton bolls even when introduced into the lint cavity with a hypodermic syringe, and in nature are evidently saprophytic following rotting of the lint by other fungi and bacteria.

The work of Nowell in the West Indies has shown that *Nematospora* spp. are transmitted from boll to boll by insects which commonly feed on cotton bolls. At present this work is being followed up here in collaboration with the Assistant Entomologist. The chief fact emerging from the experimental work carried out to date in Uganda is the extraordinary efficiency of stainers belonging to the genus *Dysdercus* in transmitting the fungus *Nematospora gossypii*. These insects have proved almost 100% efficient as vectors, that is to say, almost every boll showing evidence of attack by these insects is infected with the fungus. There is a great discrepancy between this efficient transmission and that obtained by inoculating bolls with the fungus by means of a fine needle penetrating into the lint cavity. The latter method gives successful infections in an average of 40% of the total number of inoculations. This suggests that these insects do not merely cause mechanical injury to the bolls and afford a means of entry for the fungus, but rather that they act in a similar manner to a hypodermic syringe, by actually introducing the fungus into the interior of the bolls. In the case of bolls sterilised on the outside by spraying with formalin, the insects have given rise to infection of *Nematospora* in over 90 per cent of the bolls used for the experiments. This tends to support the above theory, but on the other hand, in spite of repeated tests, I have been quite unable to detect any spores or vegetative state of the fungus either externally on the mouth parts of the insects or internally, though many of the insects examined had actually been proved to have infected cotton bolls with the fungus.

Up to the present, therefore, no evidence has been obtained as to the method in which the fungus is carried and introduced into the bolls by the insects. On the return of the Assistant Entomologist from leave, further experimental work aiming at a solution of this problem will be carried out. Other work has now been commenced to endeavour to elucidate the relation between each of the organisms enumerated above as being found in diseased bolls, and the various insects known to feed on cotton bolls in Uganda.

In connection with *Nematospora gossypii* it is worthy of note that this fungus has been found inside the ripe seeds of cotton, and also of the avocado (*Persea gratissima*), in which it was causing a dark coloured dry rotting of the seed, though no injury was apparent on the outside.

5. Sugar.

The only serious disease of this crop so far discovered in Uganda is the *Mosaic Disease*, found during the period under review on one estate only. No cases of the disease outside this estate have been discovered up to the present, and all evidence available indicates that the disease commenced to spread some time in the early part of 1926. Its origin is obscure in the extreme, as all earlier plantings are free from it and no canes have been obtained from elsewhere for some years.

At the present moment the disease is not serious in extent, though there is always risk of very rapid spread under the moist conditions of Uganda. For the present measures have been devised to keep the disease under control as far as possible, by replanting all fields showing any considerable amount of disease, and by attempting to rogue out the disease from the other fields. Under present conditions it is not deemed advisable to resort to the immune variety Uba as a means of avoiding the disease, as this would entail too much expense in planting and in modifications in the factory. It is hoped to keep the disease down by the temporary measures indicated above, until such time as a supply of cuttings of resistant and tolerant canes of the P. O. J. series is available. These varieties have recently been introduced and are being propagated as fast as is possible.

During the year a number of good quality varieties of cane were obtained from the West Indies, and these should represent a great advance on the varieties hitherto available to the industry in Uganda, provided the mosaic disease can be kept under sufficient control.

An obscure form of "Top Rot" was discovered during the year. A number of canes die off when about four to six months old, the heart leaves turning brown and drying up, while the older leaves are still healthy in appearance. On examination it is found that the young apical part of

the stem is rotten for a distance of six to ten inches from its apex. It gives off a very objectionable smell, and the tissues are full of bacteria and fungi. The latter appear to be entirely saprophytic in character, and no evidence for the parasitism of any of the bacteria has yet been obtained. The disease seems to be more or less confined to the softer yellow varieties of cane, such as B.3922, Seeley's Seedling, and certain unidentified Ceylon canes. The Striped Ribbon, Striped Bamboo, and the Tanna varieties cultivated here appear to be resistant to the disease. For various reasons the cultivation of the former group of varieties in Uganda is being abandoned in favour of the Striped and the Tanna varieties, which seem to be better suited to local conditions.

6. Tobacco.

Recently considerable interest has been taken in the development of a tobacco growing industry in Uganda, and during the period under review a watch was kept for any diseases that might attack the crop. Up to the present two diseases have been discovered, one of which, if allowed to spread, would prove extremely serious. These are the Tobacco Mosaic, and the "Black Shank" disease (called in Java "lanaziekte") caused by *Phytophthora nicotianae*. The latter is most serious in its effects, as it enters the base of the plant either through the roots or through leaf scars and the whole plant dies. It has proved an extremely serious disease of tobacco in the United States of America, in Java, and in Jamaica, as it is able to persist in the soil for a considerable number of years and renders infected areas almost useless for tobacco cultivation. Its spread in affected tobacco fields is very rapid, especially under the moist conditions usually prevailing in Uganda. In the event of the development of a considerable tobacco industry in Uganda this disease may well prove one of the most important factors to be considered. The disease has now been found on the Government Plantations at Kampala and Serere.

Tobacco mosaic is known in Uganda from only one district and is not likely to prove as serious as the "Black Shank" as, though the affected leaves are not of good quality, the plants are not killed out.

On native tobacco, infestations of the eelworm *Heterodera radiculicola* have recently been discovered, and this nematode caused some loss of crop by interfering with the normal rate of growth of the host. The infected plants do not appear to die as the result of this disease, but their growth is considerably retarded.

7. Native Crops.

Some varieties of native beans suffer considerably from the effects of the rust *Uromyces appendiculatus*. Specimens of rice received during the year showed infection by the "Blast" disease (*Piricularia oryzae*), and by *Fusarium moniliforme*, the latter being associated with a dry rot of the seeds. Two distinct wilt diseases of ground nuts (*Arachis hypogaea*) have been examined, one being caused by the attack of *Sclerotium rolfsii*, and the other associated with a *Fusarium* of the group *Elegans*, probably that formerly described in Uganda as *F. udum*, Butl.

A banana disease in Kyagwe characterised by the drying up of the leaves before the fruit ripens, and the consequent loss of the fruit, was investigated, and the only organism found present was *Heterodera radiculicola* on the roots. Almost the whole root system of the affected plants was infested with the eelworm, which is considered to be responsible for the disease.

In Bugishu and also in the islands of Lake Victoria another banana disease has been found. The plants die off and fall over, and the rhizomes are found to be rotten. The rot is light brown in colour, with small cavities in the tissues filled with sheets of a fine white mycelium, showing the clamp connections typical of the Hymenomycetes. A similar disease is caused in Jamaica by *Marasmius semiustus*, and this or a closely related fungus is probably responsible in the present instance. The disease in Jamaica is considered to be in most cases the result of poor cultivation, and is worst in fields where the grass and weeds have been allowed to grow. This is not always the case here in Uganda, but it is probable that improved cultivation and more frequent replanting of the crop would do much to control the disease. The present system of planting bananas in Uganda and letting them grow for years in a semi-wild state is far from good. The stools become congested with a mass of suckers and gradually come more and more above the surface of the soil. A system of replanting the fields every three or four years and a pruning out of many of the suckers from the stools would be much preferable. Many of the varieties cultivated here appear to be unprofitable from the point of food yields per acre.

A fruit rot of bananas has been found to be due to the attacks of *Thielaviopsis paradoxa* on the damaged fruit. This is the first record of this fungus in Uganda. A common ripe rot of the banana is due to *Gloesporium*.

8. Miscellaneous.

The host range of *Rhizoctonia bataticola* has been extended to include *Buddleia*, *Panax*, *Cupressus*, orange, lemon, cocoa and roses.

Fusarium spp. have been found in a rotting of potato tubers (*Solanum*), and cases of potato scab caused by *Actinomyces scabies* have been found in native grown potatoes in the local markets. "Early Blight" *Alternaria solani* has been found in one district but the damage caused was not important.

Heterodera radiculicola has been found on beetroot; *Isariopsis griseola* on *Vigna* sp., *Fusarium moniliforme* on dead cotton seedlings, secondary to *Rhizoctonia bataticola*; *Melampsorella ricini* on *Ricinus communis*; *Cephalosporium lecanii* on various scale insects, and *Sclerospora* sp. on *Sorghum*.

A considerable collection of specimens of Uganda fungi collected during the year has been forwarded to Kew for identification and will finally be included in the mycological herbarium here, which has been put into order and revised. Recently the new Agricultural Laboratories have been partially opened and all apparatus and books have been removed from the old laboratory. During the period under review considerable attention has been paid to the sugar industry and advice given where necessary, dealing with the cultivation and diseases of this crop.

In conclusion I have to record my thanks to the staffs of the Imperial Bureau of Mycology and of the Royal Botanic Gardens, Kew, for help in the identification of specimens and in many other directions; also the Director of Agriculture, Jamaica, and Dr. E. W. Brandes, of Washington, United States of America, for sending cuttings of new varieties of sugar cane.

C. G. HANSFORD,
Mycologist.

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST.

I was on leave from the beginning of the year until October 10th. During that period I spent seven weeks at Rothamsted Experimental Station to regain touch with the latest ideas in Agricultural Research, particularly in the lay-out and treatment of field experiments. I was also privileged to attend the First International Congress of Soil Science in America during June and July.

Experimental.

Since my return I have visited the plantations of Messrs. D. N. Stafford (Hoima) and Lea Wilson (Namatumbe) to see the results of various manurial experiments on *coffea arabica*.

On the former estate treatments with lime, cyanamide, guano, rotted pulp and parchment, cotton seed ash, ADCO artificial farmyard manure and rotted cotton seed have been laid down on various blocks. The rotten cotton seed had been applied over what was probably the worst coffee in the plantation and within six months the trees had recovered their foliage and were in full bloom when I saw them. Although it is early to say that the results of this treatment are entirely beneficial it would be advisable for all other planters who are in a position to do so to try cotton seed on say twenty acres to judge for themselves its value.

The only other treatments to show any benefit at all were the pulp plus parchment and ADCO.

Mr. Lea Wilson had also used cotton seed and he had tried a thick mulch of elephant grass on another block with complete success in each case.

Unfortunately the ADCO experiment on the Kampala Plantation has yielded no data because the shade of *Grevillea robusta* has become much too thick during the year. The trees look healthier than before the manure was applied but have borne no crop owing to the depth of shade.

These trials prove my contention that the main thing needed in our soils is humus, particularly on those plantations which have been clean weeded for years. At the risk of undue insistence, although this point cannot be over-emphasised, I would like to draw the attention of planters to my paper on humus read at their annual meeting in 1926. The lime and green manure experiments on cotton have been continued; the cotton is just being harvested, but I do not expect valuable results this year owing to the weather.

An experiment was also designed to test the exhaustive effects on the soil of various food crops with a view to planning a suitable rotation. The effect of each crop being measured by the yield of the succeeding cotton crop. Unfortunately the value of the two latter experiments has been vitiated to a certain extent by the unusually dry season. These experiments will be continued for a number of years to accumulate sufficient data to draw conclusions.

Laboratory.

The new laboratory is finished except for the water and gas supplies. As soon as these are ready we shall be in a position to undertake soil analyses and research work.

W. S. MARTIN,
Agricultural Chemist.

IMPERIAL INSTITUTE.

Report on Tobacco from Uganda.

The two samples of tobacco which are the subject of this report were received at the Imperial Institute on the 14th November, 1927, from the Director of Agriculture and are referred to in his letter No. 1626/322 of the 27th September, 1927.

The tobaccos were stated to have been grown on rather heavy land at Bulindi, Bunyoro, Northern Province, and cured by the open fire method.

DESCRIPTION.

No. 1.—This sample was stated to represent a heavy type of Virginia tobacco from seed grown at Serere Plantation, Teso District, for many years; the name of the variety was unknown.

The sample weighed $1\frac{1}{4}$ lb. and consisted of two hands of tobacco of an even darkish to medium warm brown colour. The leaf was of fair substance, but was rather papery along the midrib and inclined to be harsh and brittle. The midrib was rather heavy; the butts well feathered. The veins were small but wiry. The size of the leaves varied from 24 in. $\times$ 8 in. to 29 in. $\times$ 11 in.

No. 2.—This was stated to represent the variety "Piet Retief Swazie," the seed of which was received from the Department of Agriculture at Pretoria.

The sample weighed $1\frac{1}{4}$ lb. and consisted of two hands of tobacco of an even medium warm brown colour. The leaf was lacking in substance, brittle and papery, especially along the midrib. The midrib was rather heavy; the butts well feathered. The veins were small but wiry. The size of the leaves varied from 25 in. $\times$ 10 in. to 28 in. $\times$ 11 in.

The two tobaccos were very similar in colour but No. 1 was of better substance. Both samples were in good unbroken condition.

RESULTS OF EXAMINATION.

The tobaccos, after removal of the midribs, were analysed with the following results, which are calculated for leaf containing 14 per cent of moisture:—

				<i>No. 1.</i> <i>Per cent.</i>		<i>No. 2.</i> <i>Per cent.</i>	
Moisture	...	...	...	14.0	...	...	14.0
Nicotine	...	...	...	5.59	...	...	5.66
Nitrogen	...	...	...	4.43	...	...	4.42
Ash	...	...	...	12.5	...	...	11.8

The ash of sample No. 1 was analysed with the following results:—

					<i>Ash, as prepared.</i> <i>Per cent.</i>		<i>Calculated on CO₂</i> <i>— free ash.</i> <i>Per cent.</i>	
Lime	...	...	...	CaO	...	27.51	...	35.25
Magnesia	...	...	...	MgO	...	12.73	...	16.31
Potash	...	...	...	K ₂ O	...	23.46	...	30.05
Soda	...	...	...	Na ₂ O	...	0.78	...	1.00
Sulphates, expressed as sulphuric anhydride				SO ₃	...	3.89	...	4.98
Chlorides, expressed as chlorine				Cl	...	2.84	...	3.64
Carbonates, expressed as carbon dioxide				CO ₂	...	21.95	...	—

The foregoing results show that the two samples are of very similar composition and contain high percentages of nicotine and nitrogen. The composition of the ash (of No. 1) is satisfactory, the percentage of potash being normal and the total amount of sulphates and chlorides satisfactorily low.

Smoking Trials.—The leaf of sample No. 1 was found to burn satisfactorily, leaving a white ash, but the flavour was considered to be rather coarse and pungent. The flavour of No. 2 was generally similar but the combustion was not quite so good.

COMMERCIAL VALUE.

The samples were submitted to merchants and manufacturers, who reported on them as follows:—

(1) The merchants stated that both samples represented a very good and useful type of leaf comparing very favourably with similar classes of tobacco produced in Southern Rhodesia and Nyasaland. Such leaf could probably be utilised as a spinning wrapper in the United Kingdom. Of the two samples, the firm described No. 2 as the leafier and wider and probably more useful for the purpose mentioned, except that the stalk was rather markedly heavy, especially at the butt ends, which would be a disadvantage. No. 1 had relatively a much smaller stalk and this factor might outweigh its inferiority to No. 2 as regards leafiness and width.

The firm were of opinion that bulk shipments of tobacco of similar quality to the samples, *i.e.*, equally leafy and broad, should realise about 1s. 8d. to 1s. 9d. per lb. in London at the present time, but they pointed out that at the moment the market for Colonial tobacco is affected by the large increase in production which has recently taken place, especially in Nyasaland and Rhodesia.

(2) The manufacturers expressed themselves as favourably impressed with the tobaccos, especially with sample No. 1, which they described as having length, very fair body, good texture and appearance, and a pleasantly fired flavour. They stated that No. 2 had a pleasing appearance but was inferior to No. 1 in body and texture. They pointed out, however, that the final test of the leaf would be its smoking quality when manufactured, and stated that if a few trial bales of the Virginia tobacco represented by sample No. 1 could be forwarded to them they would be glad to carry out manufacturing tests and furnish an opinion as to the value of the leaf and the prospects of marketing it in the United Kingdom.

Remarks.

These two samples of tobacco are of promising quality. The amounts of nicotine and nitrogen present in the leaf are, however, high, and adversely affect the flavour of the tobacco when smoked. High percentages of these constituents are often due to excessive nitrogenous manuring.

It would appear advisable to take advantage of the offer of the manufacturers to receive a few trial bales for practical tests, and if it is found possible to arrange for such a shipment the Imperial Institute will be glad to give any assistance that may be required in connection with the matter.

23RD MARCH, 1928.

Appendix No. 2.

Spinning Test on New Strains of Cotton.

The following is an extract of the report of the spinning test of the strains S.G. 15, S.G. 26, S.G. 27 and S.G. 29 :—

BROKER'S REPORT.

S.G. 15	...	Strict good middling, creamy colour.	1 3/16th mixed with short hairs.	Medium to strong.	Fine and lustrous	...	1
S.G. 26	...	"	1 3/16th	"	Wanting in fineness and lustre		2
S.G. 27	...	"	1 1/8th	"	"	"	4
S.G. 29	...	"	1 1/8th to 1 3/16th	"	"	"	3

SPINNER'S REPORT.

Strain.	Nominal Count and Yarn Type.	Amount Twist given (turns per inch.)	Total Waste. %	Strength (Lea Test in lbs.)	Work of Rupture (inch lbs. per lea.)	Actual Count.
S.G. 15	58s twist carded.	27.63	8.7	34.1	43.5	60.2
S.G. 26	"	27.63	10.0	27.8	37.0	58.4
S.G. 27	"	27.63	10.5	28.9	38.5	58.9
S.G. 29	"	27.63	11.6	28.1	38.5	58.8
East African control, but origin unknown	"	27.63	10.9	26.7	36.3	58.9

Yarn examination.—Order of merit as judged from appearance on the blackboards :—

- 1.—East African control.
- 2.—S.G. 26.
- 3.—S.G. 27.
- 4.—S.G. 29.
- 5.—S.G. 15.

S.G. 26 is nearly as good as the control and would be superior but for one or two neps. S.G. 15 is rather neppy and uneven.

The arrangements for conducting these tests were made by the Empire Cotton Growing Corporation. Thanks are due to the Liverpool Cotton Association and to the firm who examined the samples and to the Cotton Research Association and the spinners who kindly carried out the spinning tests.

IMPERIAL INSTITUTE.

Report on Cinchona Bark from Uganda.

The sample of cinchona bark which is the subject of this report was received at the Imperial Institute on the 18th July from the Director of Agriculture, Uganda, and is referred to in his letters No. 1012/522 of the 8th June and No. 1536/522 of the 6th September, 1927.

It was stated that the bark had been collected from six-year-old trees grown on the Government Plantation, Bukalasa, Mengo District, from seed obtained from the Amani Institute. The trees are probably *Cinchona robusta*, but this identification is subject to confirmation later.

The bark was obtained by coppicing, the trees being cut down to the ground level and the bark completely removed from all large branches and stems. Five trees produced twenty-two pounds of dried bark, representing an average yield per tree of nearly 4½ lbs.

DESCRIPTION.

The sample weighed about 10 lbs. on arrival at the Imperial Institute and consisted of quills of bark varying greatly in appearance, size and thickness. The length of the quills ranged up to a maximum of 8½ inches and the thickness of the bark from about 1/64 to 3/16 inch. The quills were coated to a varying extent with patches of yellowish-green or grey lichen and showed transverse cracks but no well marked longitudinal furrows. The thinner bark was pale dull brown on the outer surface, and bright yellow brown on the inner surface. The thicker bark was rough and dark brown externally, but fairly smooth and of a medium brown colour on the inner surface.

RESULTS OF EXAMINATION.

On chemical examination the bark furnished the results given in the following table in comparison with those obtained with a sample of *Cinchona robusta* bark received at the Imperial Institute from the Amani Institute in 1918.

	Present Sample.		Sample from the Amani Institute.	
	Expressed on sample as received.	Expressed on moisture-free material.	Expressed on sample as received.	Expressed on moisture-free material.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Moisture	10·3	—	8·1	—
Total Alkaloids	6·95	7·75	7·61	8·28
Including Quinine*	2·74	3·05	2·66	2·90
*Equivalent to crystalline quinine sulphate	3·72	4·15	3·55	3·84

These results show that the present sample of cinchona bark from Uganda closely resembles in composition the previous sample of *Cinchona robusta* bark from the Amani Institute.

COMMERCIAL VALUE.

A sample of the bark, together with the results of analysis, was submitted to a firm of brokers for valuation. They described the material as "mixed broken, stem branch and twig bark, thin papery, fairly bright and a little mossy," and regarded its value for manufacturing purposes as about 4d. to 4½d. per lb. *ex* wharf London (25th October, 1927). They added that such bark would probably meet with a fairly ready demand at this price.

REMARKS.

The results of the investigation of this cinchona bark show that the amount of total alkaloid and of quinine resemble those present in *C. Calisaya* bark, which usually contains about 6 to 7 per cent of total alkaloids including 3 to 4 per cent of quinine. Consignments of similar character to the present sample would probably be readily saleable in London for manufacturing purposes, although as a source of quinine it is inferior to Ledger bark of good quality.

C. robusta bark cannot be used for making the official cinchona preparations of the British Pharmacopoeia, for which purpose *C. succirubra* is alone specified.

Native Agriculture—Estimate of Approximate Acreages of Crops under Cultivation.

Province and District.	Plantains		Potatoes.		Millets.		Cotton.		Coffee.		Rubber.		Sim-Sim.	Ground Nuts.	Chillies.	Maize.	Rice.	Wheat.	Beans.	Peas.	Tobacco.	Sugar Cane.	Cassava.	Miscellaneous Crops.	
	Sweet.	English.	Mama.	Winbi.	Robusta.	Arabica.	Para.	Other.																	
ACRES.																									
BUGANDA :—																									
	210,000	40,000	300	2,300	5,300	108,000	345	200	100	50	8,500	4,300	100	700	70	10,500	850	27,800	10,500	500	1,600	9,000	1,000		
	84,000	18,000	270	900	150	30,000	630	110	10	..	1,300	2,000	10	2,850	..	8,300	50	8,300	50	200	900	4,500	..		
	60,000	15,000	50	3,000	500	22,000	1,014	200	50	..	150	2,000	500	1,500	..	3,000	500	3,000	500	20	10	2,000	500		
	25,000	25,500	75	2,300	11,000	30,000	500	140	..	..	1,200	2,500	80	6,000	..	6,000	100	6,000	100	800	160	3,000	500		
TOTAL	379,000	98,500	695	8,500	16,950	200,000	2,490	556	160	50	6,150	10,800	720	11,050	70	27,800	850	1,520	2,670	22,500	1,500				
EASTERN :—																									
	85,000	32,000	100	4,000	10,000	77,654	..	25	..	..	400	500	500	500	80	600	..	4,500	150	50	5,000	100			
	15,000	7,300	..	2,800	33,000	21,710	..	..	..	..	800	1,100	20	500	2,100	4,500	..	4,500	30	10	4,500	..			
	20,000	8,000	..	2,000	36,000	55,000	..	..	..	..	1,000	1,500	20	2,000	2,000	2,500	..	2,500	10	50	3,000	..			
	50,000	13,000	100	2,000	22,000	25,500	..	881	2	..	300	700	20	2,000	4,300	1,000	20	1,000	80	10	800	600			
	1,300	38,000	..	5,000	96,000	69,737	..	..	..	..	6,800	20,000	..	2,000	450	12,000	15,000	7,000	..	..	..	..			
	500	30,000	..	25,000	100,000	53,000	..	..	..	..	22,000	8,000	..	1,000	160	..	..	..	..	..	..	..			
TOTAL	171,800	134,310	200	44,800	297,500	302,601	..	909	2	..	31,330	31,800	500	8,025	9,040	30,600	15,020	30,600	310	80	58,500	700			
NORTHERN :—																									
	7,000	12,000	30	500	10,000	9,750	40	210	..	..	6,000	2,000	3	500	..	7,000	500	7,000	155	10	1,000	..			
	30	2,100	..	5,000	40,000	10,980	..	1	..	..	15,000	1,000	..	160	20	300	..	300	3	..	10	..			
	..	2,500	..	12,000	30,000	7,023	..	..	..	..	15,000	400	..	..	..	500	..	500	..	..	..	..			
	70	30,000	12	60,000	76,000	300	..	4	..	..	20,000	800	..	..	..	10,000	8,000	10,000	..	..	2,500	..			
TOTAL	7,100	46,600	42	77,500	156,000	28,003	40	215	..	..	56,000	4,200	3	660	20	17,800	8,500	17,800	158	10	3,510	..			
WESTERN :—																									
	34,000	13,000	50	2,000	30,000	2,400	225	83	..	..	100	500	50	2,000	300	15,750	1,000	15,750	150	200	1,800	100			
	35,000	20,000	50	1,500	35,000	..	50	100	..	..	5	500	50	500	..	17,000	10,000	17,000	100	10	300	100			
	12,000	25,000	10	43,000	25,000	..	..	5	..	..	..	..	..	8,000	..	22,000	20,000	22,000	100	5	20	..			
TOTAL	81,000	58,000	110	46,500	90,000	2,400	305	188	..	..	105	1,000	100	10,500	300	54,750	31,000	54,750	350	215	2,120	200			
GRAND TOTAL	638,900	337,410	1,047	177,300	569,450	533,004	2,835	1,962	162	50	93,585	17,800	1,383	30,235	9,430	130,950	55,370	130,950	2,108	3,205	86,630	2,400			

* Including 425 acres in Sese and Buvuma Islands.
 NOTE :—The acreage under Robustia Coffee is computed at 300 trees per acre and the acreage under Arabica Coffee at 700 trees per acre.

Native Agriculture—Live-Stock.

PROVINCE AND DISTRICT.				Cattle.	Sheep.	Goats.	Mules.	Donkeys.	Pigs.
BUGANDA :—									
Mengo	...	...	...	55,895	19,931	155,730	2	—	—
Entebbe	...	...	...	27,998	9,960	74,841	—	—	106
Masaka	...	...	...	60,271	15,222	47,312	1	2	10
Mubende	...	...	...	27,576	9,400	76,318	—	2	—
TOTAL			...	171,740	54,513	354,201	3	4	116
EASTERN :—									
Busoga	...	...	...	75,000	26,000	173,300	—	—	—
Budama	...	...	...	79,676	7,687	25,877	—	—	—
Bugwere	...	...	...	62,418	11,494	129,152	—	—	—
Bugishu	...	...	...	142,317	35,456	111,083	—	—	—
Teso	...	...	...	277,450	39,926	84,391	1	24	14
Lango	...	...	...	259,786	35,389	62,911	—	—	—
Karamoja	...	...	...	150,000	450,000	45,000	2	8,000	—
TOTAL			...	1,046,647	605,952	631,714	3	8,024	14
NORTHERN :—									
Bunyoro	...	...	...	7,838	7,287	28,991	4	2	—
Gulu	...	...	...	47,915	19,197	38,735	—	21	—
Chua	...	...	...	20,500	20,628	21,942	—	—	—
West Nile	...	...	...	82,100	19,800	24,000	6	2	3
TOTAL			...	158,353	66,912	113,668	10	25	3
WESTERN :—									
Toro	...	...	...	77,682	34,093	73,249	—	10	30
Ankole	...	...	...	216,986	89,787	136,096	—	10	—
Kigezi	...	...	...	60,000	60,000	150,000	—	—	—
TOTAL			...	354,668	183,880	359,345	—	20	30
GRAND TOTAL			...	1,731,408	911,257	1,458,928	16	8,073	163

European Agriculture.

COMPILED FROM RETURNS FROM 210 PLANTATIONS.

PROVINCE AND DISTRICT.	Number of Estates.	Total acreage taken up.	Total acreage cultivated.	Total acreage not cultivated.	Acreage of Coffee (<i>Arabica</i>).		Acreage of Coffee (<i>Robusta</i>).		Acreage of Para Rubber.		Acreage of Cacao.		Acreage of Tea.		Sugar.	Tobacco.	Miscel- laneous Crops. (5)
					Not yet bearing.	Of bearing age.	Not yet bearing. (1)	Of bearing age. (2)	Under 7 years. (3)	Over 7 years. (4)	Under 5 years.	Over 5 years.	Under 5 years.	Over 5 years.			
ACRES.																	
BUGANDA :—	79	38,741	10,795	27,946	174	2,752	1,456	817	961	6,419	—	4	—	—	50	14	322
	19	7,127	2,301	4,826	7	919	355	103	250	981	—	—	50	—	—	—	15
	22	7,426	1,633	5,793	—	1,181	283	6	—	350	—	—	—	—	—	—	10
	12	7,513	1,776	5,737	85	1,392	140	85	10	—	—	—	78	102	—	—	7
	TOTAL	132	60,807	16,505	44,302	266	6,244	2,234	1,011	1,221	7,750	—	4	128	102	50	14
WESTERN :—	49	23,933	3,130	20,803	488	2,492	60	—	—	—	—	—	12	2	—	—	71
Toro	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
NORTHERN —	20	12,120	3,190	8,930	37	2,500	191	74	105	812	—	—	—	—	—	4	167
Bunyoro	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
EASTERN :—	9	10,196	1,424	8,772	—	964	42	138	30	120	—	—	—	—	210	—	40
Busoga	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
GRAND TOTAL	210	107,056	24,249	82,807	791	12,200	2,527	1,223	1,356	8,682	—	4	140	104	260	18	632

(1) 552 acres interplanted with *C. arabica*.

(2) 34 " " " " " " and 40 acres with *C. robusta*.
 (3) 1,882 " " " " " "
 (4) 648 " " " " " "
 (5) 20 " " " " " "

Indian Agriculture.

COMPILED FROM RETURNS FROM 32 PLANTATIONS.

PROVINCE AND DISTRICT.	Number of Estates.	Total acreage taken up.	Total acreage cultivated.	Total acreage un-cultivated.	Acreage of Coffee (<i>Arabica</i>).		Acreage of Coffee (<i>Robusta</i>).		Acreage of Para Rubber.		Acreage of Cacao.		Acreage of Tea.		Sugar.		Cotton. (3)	Miscellaneous Crops.
					Not yet bearing.	Of bearing age.	Not yet bearing.	Of bearing age.	Under 7 years. (1)	Over 7 years. (2)	Under 7 years.	Over 7 years.	Under 7 years.	Over 7 years.	Plant Canes.	Ratoon Canes.		
ACRES.																		
BUGANDA :—	14	12,031	5,600	6,431	—	120	70	535	20	800	—	—	—	—	3,265	1,350	50	—
	4	1,400	236	1,164	41	30	75	—	—	—	—	—	—	—	45	70	—	20
	2	1,600	487	1,113	—	85	30	15	—	170	—	20	2	—	85	—	80	65
	2	1,365	402	963	—	200	—	—	—	—	—	—	—	—	200	—	—	—
TOTAL	22	16,396	6,725	9,671	41	435	175	550	20	970	—	20	2	—	3,595	1,420	130	85
WESTERN :—	2	545	79	466	18	51	—	—	—	—	—	—	—	—	—	—	—	10
	1	100	—	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—
NORTHERN :—	7	5,880	1,182	4,698	—	25	20	187	—	800	—	—	—	—	90	—	—	60
	32	22,921	7,986	14,935	59	511	195	737	20	1,770	—	20	2	—	3,685	1,420	130	155

(1) 20 acres interplanted with *C. robusta*.
 (2) 500 " " " and 95 acres with *C. arabica*.
 (3) 103 " " "

Appendix No. 8.

Live-Stock on European and Indian Plantations.

PROVINCE AND DISTRICT.			Cattle.	Sheep.	Goats.	Mules.	Donkeys.	Pigs.
BUGANDA—Mengo	(i)	...	288	2	...	4	3	...
	(ii)	...	41	...	...	2	2	...
	Entebbe	(i)	117	...	...	...	...	...
		(ii)	5	...	...	...	...	...
	Masaka	(i)	168	...	...	...	...	...
		(ii)	18	...	12	...	3	...
Mubende	(i)	...	605	76	30	...	...	...
TOTAL	(i)	...	1,178	78	30	4	3	...
	(ii)	...	64	...	12	2	5	...
EASTERN—Busoga	(i)	..	46	60	140	...	...	...
NORTHERN—Bunyoro	(i)	...	67	2	...	3	...	...
WESTERN—Toro	(i)	...	229	10	17	11	10	3
	(ii)	...	6	...	...	...	...	...
GRAND TOTAL	(i)	...	1,520	150	187	8	13	3
	(ii)	...	70	...	12	2	5	...
			1,590	150	199	10	18	3

(i) European.

(ii) Indian.

Appendix No. 9.

Comparative Statement of Uganda Produce Exported from Mombasa for the Year Ended 31st December, 1927.

ARTICLES.	Unit.	From 1st January to 31st December, 1927.		From 1st January to 31st December, 1926.		INCREASE.		DECREASE.	
		Quantity	£	Quantity	£	Quantity	£	Quantity	£
Cotton, Raw ...	centals	526,911	1,690,838	723,438	3,051,791	...	...	196,527	1,360,953
Cotton, Seed ...	tons	29,500	170,303	35,360	194,887	...	...	5,860	24,584
Coffee, Raw ...	cwts.	48,514	170,407	38,211	147,884	10,303	22,523	...	...
Rubber, Plantation ...	centals	14,463	82,077	13,561	135,619	902	...	...	53,542
Rubber, Wild ...	...	33	84	...	...	33	84	...	...
Chillies ...	cwts.	1,308	4,359	1,245	1,715	63	2,644	...	...
Jaggery (Unrefined Sugar) ...	"	436	425	272	215	164	210	...	...
Sugar, Refined ...	"	10,161	16,371	1,255	1,599	8,906	14,772	...	...
Ground Nuts ...	tons	2	40	380	6,026	...	...	378	5,986
Cocoa ...	cwts.	64	160	10	18	54	142	...	...
Sim-sim Seed ...	tons	718	13,732	194	4,130	524	9,602	...	...
Sim-sim Oil ...	gals.	88	25	...	...	88	25	...	...
Skins, Sheep and Goat ...	No.	78,411	4,091	88,750	5,173	...	...	10,339	1,082
Hides, Dry and Dry Salted ...	cwts.	29,619	99,541	7,640	27,357	21,979	72,184	...	...
Ivory ...	...	499	34,574	202	18,289	297	16,285	...	...
Hippo Teeth ...	"	2	15	10	86	...	...	8	71
Horns ...	"	4	453	4	346	...	107	...	...
Metalliferous Ores, Non-Ferrous ...	tons	117½	20,875	...	...	117½	20,875	...	...
Methylated Spirits ...	gals.	638	96	...	...	638	96	...	...
Timber ...	cu. ft.	4,637	917	5,144	1,703	...	...	507	786
Goods, Manufactured, unenumerated ...	value.	...	162	...	177	...	...	...	15
Goods, Unmanufactured, " ...	"	...	62	...	82	...	...	...	20
Miscellaneous Exports ...	"	...	653	...	340	...	313	...	...
TOTALS	...	...	2,310,260	...	3,597,437	...	159,862	...	1,447,039

Net decrease:—£1,287,177.

ARTICLES.	Unit.	Year ended 31st Dec., 1923.		Year ended 31st Dec., 1924.		Year ended 31st Dec., 1925.		Year ended 31st Dec., 1926.		Year ended 31st Dec., 1927.	
		Quantity	£	Quantity	£	Quantity	£	Quantity	£	Quantity	£
Cotton, Raw ...	centals	352,184	2,026,820	514,418	3,486,565	784,152	4,685,992	723,438	3,051,791	526,911	1,690,838
" , Seed ...	tons	9,794	52,964	21,093	106,280	21,928	122,790	35,360	194,887	29,500	170,303
Coffee, Raw ...	cwts.	40,931	108,490	41,093	167,696	29,883	139,469	33,211	147,884	43,514	170,407
Rubber, Plantation ...	centals	3,986	9,926	6,083	18,911	8,058	68,704	13,561	135,619	14,463	82,077
" , Wild ...	...	...	...	...	...	...	...	...	...	33	84
Chillies ...	cwts.	18,223	58,660	21,357	35,499	2,257	2,935	1,245	1,715	1,308	4,359
Ghee (Clarified Butter) ...	"	128	365	3	9	...	...	...	...	...	...
Jaggery (Unrefined Sugar)...	"	1,127	921	48	33	338	245	272	215	436	425
Sugar, Refined ...	"	...	...	319	698	4,053	7,447	1,255	1,599	10,161	16,371
Groundnuts ...	tons	175	2,714	89	1,446	41	820	380	6,023	2	40
Cacao ...	cwts.	399	1,079	118	499	115	311	10	18	64	160
Sim-sim, Seed...	tons	1,435	24,383	740	15,602	214	4,523	194	4,130	718	13,732
" , Oil ...	gals.	16	4	...	...	...	...	...	...	88	25
Castor Seed ...	tons	10	114	...	...	...	...	...	...	...	...
Skins, Sheep and Goat ...	No.	314,914	14,839	274,915	14,175	55,350	4,014	88,750	5,173	78,411	4,091
" , Miscellaneous ...	"	16	32	55	26	...	...	...	...	...	...
Hides, Dry and Dry Salted	cwts.	10,423	28,855	7,172	24,347	7,027	29,843	7,640	27,357	29,619	99,541
Ivory ...	"	807	58,673	269	22,909	307	28,535	202	18,289	499	34,574
Hippo Teeth ...	"	101	1,271	30	732	1	9	10	86	2	15
Horns ...	"	15	1,033	3	224	1	86	4	346	4	453
Metaliferous Ores, Non-Ferrous	tons	...	...	...	...	...	...	...	...	117½	20,875
Methylated Spirits	gals.	...	...	...	...	...	...	...	...	638	96
Timber	Cu.ft.	50,194	541	2,151	323	359	75	5,144	1,703	4,637	917
Goods, manufactured, unenumerated	Value	...	161	...	274	...	53	...	177	...	162
" , unmanufactured unenumerated	"	...	123	...	352	...	345	...	82	...	62
Miscellaneous Exports	"	...	1,710	...	795	...	521	...	340	...	653
TOTALS	...	...	2,393,678	...	3,897,395	...	5,096,717	...	3,597,437	...	2,310,260

Appendix No. 11.

Details of Machinery at Licensed Ginneries in the Uganda Protectorate—Season 1927.

PROVINCE AND DISTRICT.		Ginneries.	Gins.		Seed Openers.	Presses.		Engines.			Delinters.	
			Roller.	Saw.		Hand.	Power.	Steam.	Oil.	Suction Gas.		
EASTERN :—												
Busoga	...	34 (a)	389	15	31	21	14	29	8	1	—	
Budama	...	7	35	25	3	6	5	3	2	2	—	
Bugwere	...	13	115	22	10	11	9	6	3	3	—	
Bugishu	...	4	49	2	4	2	3	3	—	1	—	
Teso	...	25 (b)	222	23	21	15	17	10	2	13	1	
Lango	...	16	122	16	15	7	11	12	1	4	—	
TOTAL		...	99	932	103	84	62	59	63	16	24	1
BUGANDA :—												
Mengo	...	45 (c)	521	3	45	16	25	30	6	9	2	
Entebbe	...	10	109	1	10	3	4	10	—	—	—	
Masaka	...	9 (d)	91	1	8	2	6	9	—	—	—	
Mubende	...	11	96	3	10	9	1	10	1	—	—	
TOTAL		...	75	817	8	73	30	36	59	7	9	2
NORTHERN :—												
Bunyoro	...	4	32	2	3	1	4	3	1	—	—	
Gulu	...	4	40	—	4	2	2	4	—	—	—	
Chua	...	1	12	—	1	1	—	1	—	—	—	
West Nile	...	1	—	2	—	—	1	1	—	—	—	
TOTAL		...	10	84	4	8	4	7	9	1	—	—
WESTERN :—												
Toro	...	1	6	—	1	—	—	1	—	—	—	
Ankole	...	1	—	1	—	—	—	1	—	—	—	
TOTAL		...	2	6	1	1	—	2	—	—	—	—
			186	1,839	116	166	96	102	133	24	33	3
Machinery at completed but unlicensed ginneries		...	3	29	—	3	3	3	—	—	—	—
GRAND TOTAL		...	189	1,868	116	169	99	102	136	24	33	3

(a)	Including 1 closed ginners which did not work.				
(b)	" 1 "	ginners	"	"	"
(c)	" 1 "	"	"	"	" and excluding 2 press houses.
(d)	" 3 "	ginners	"	"	"

